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ABSTRACT

This is a collection of articles from the "DGWS (Division for Girls and Women's Sports) Aquatic Guides" from 1963-1969. All articles, with one exception, were revised to present the most important contributions for that time period in aquatic activity beyond simple swimming. Included in the selection are articles on fear and the non-swimmer, deep water the first day, swimming for the rehabilitation of the physically handicapped, synchronized swimming, water skiing techniques, and girls' speed swimming. (JA)

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SPORTS ARTICLES REPRINT SERIES

Selected Aquatics Articles

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Preface

The era from 1963-1969 was one of an increasing interest in swimming as an instructional and recreational activity and the use of the water as a means of enjoyment beyond swimming. Activities receiving increased attention in the DGWS *Guides* were water skiing, kayak use, and water polo. The volume of articles relating to synchronized swimming also increased. Two significant changes during this period were elimination of form swimming as a competitive event and changes in the American Red Cross recommendations for instruction.

Selection of the articles was based upon a general equitable quota in each area and upon relevance to today's aquatic interests. With the exception of the article by Beulah Gundling, which was taken from a former reprint, articles were revised in order to present the most important contributions.

Annie Clement
Editor

Swimming Instruction

Fear and the Non-Swimmer

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Most teachers agree that anxieties about water will inhibit the progress of a beginner to such a degree that achievement in swimming skills, in some cases, may be delayed for a long time.

The presence of fear in the beginner may be obvious to the instructor by the student's verbal expressions of fear or by her reluctance to enroll in a swimming course. The instructor may readily detect apprehension of the student as she observes her first reaction to the water. The fearful non-swimmer will hunch her shoulders and cling to the side of the pool. She will avoid submerging and will guard against putting her face below the surface of the water. Such reactions indicate that a careful approach is necessary to eliminate this fear and develop confidence in herself and the teacher. Sound teaching techniques and the establishment of wholesome teacher-student relationships must be directed toward these ends.

The student's mental preparation and the manner with which it is carried out have significant bearing on her attitude toward swimming. Her willingness to learn is often developed after a discussion with an honest, sympathetic, and understanding teacher. It is extremely important that the instructor gain the student's confidence and trust in her teaching ability. The speed at which the non-swimmer loses her apprehension and fear is directly influenced, in part, by this understanding and trust in the instructor.

Time should be taken to tell the student that she will attempt skills only when she feels she is ready, that those skills taught will be within the ranger of her ability, and that the achievement of aquatic skills will be an enjoyable and satisfying experience. A brief talk on the depth of the water, entering and leaving the pool, the area used for non-swimmer work, the course content, and the primary instructional objectives help to prepare the student for the water. Confidence is developed when the student knows that she will be safe in the water and that the teacher is fully aware of her anxieties.

The progress of the non-swimmer will be influenced by her willingness to learn, her confidence in the instructor, and the speed with which she loses her fear of attempting water skills. She may fear the most elementary skills such as holding the breath with the face below the surface of the water, prone float, back float, turnovers from back to front and front to back, and side glides.

The student rapidly loses her fear and gains confidence with each successful achievement. The degree and speed of learning is influenced by the teaching methods and special techniques which the instructor employs. The methods and techniques selected should offer physical security to the non-swimmer as she performs individual skills. If she knows that she may hold onto the trough or keep her feet on the bottom of the pool whenever possible, she will be more assured. Her point of concentration will be on the proper execution of the skill rather than on the part of the skill which frightens her. During the execution of buoyancy techniques, such as front and back floats and turnovers, security is offered to the student if it is explained that the maneuver will be done close to the shallow end of the pool, that the skill will be of short duration and that she will be asked to stand as soon as her feet lift from the bottom. A thorough explanation on how to regain a standing position from a float gives increased confidence to the student.

When teaching fundamental skills to non-swimmers, the teacher must have complete knowledge of the materials and have the ability to break them into their smallest teachable parts. A beginner will lose some apprehension in performance of skills if they are presented as simple, precise movements which are easily accomplished. The instructor should teach progressions in their proper order and include only that part of the technique which the student can successfully master. Each step should be explained and demonstrated exactly as it is to be executed. The mastery of simplified skills that were readily and comfortably accomplished will usually encourage the student to seek further learning.

The student's readiness to attempt new skills should be observed and recognized each time a progression is introduced. If she hesitates to try new skills even after encouragement, showing fear and tension, it is obvious that she is not ready for the new work. The new progression should be temporarily forgotten and more practice should be devoted to the previously learned and familiar skills. If a failure occurs in any given skill, it should never be allowed to stand, and some degree of success should be experienced before leaving the situation.

The teacher and student should work together to strive for skill achievement in each lesson. The proper attitude of the instructor and the wholesome relationship she establishes with the non-swimmer as she teaches will aid in eliminating fear. A positive approach, encouragement and praise, a kind voice, and sincere interest in the student are important in helping the beginner develop self-confidence and experience success in learning to swim.

Deep Water the First Day

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One day a student remarked by chance, "If I were not made to get into deep water, I would never have really learned to swim." This comment stirred some serious thoughts about the sequence of skills employed in teaching beginning swimming. What is our objective? True, we hope that each beginner will learn to sustain himself in deep water and know the safety and rescue skills within his capacity. However, it seems that a great deal of emphasis is placed on perfection of locomotive skills by one or more methods of acceptable standardized stroking. So much effort is placed on this phase of instruction that often the student of this method can swim well in water of standing depth or is quite proficient as long as he is in a horizontal position. But what happens to this person when he suddenly finds himself in deep water, and in a vertical or even inverted position? Panic ensues! Although these situations are not likely to occur, there is some possibility of this happening. Is it not the teacher's responsibility to prepare for such an emergency?

Another objective which is frequently overlooked is that of the comfort and enjoyment of the student. The beginner who has overcome the fear that prevents freedom in the water will continue to explore her potential and learn more quickly than the tense person who cannot listen to the teacher's instructions because she is constantly worrying about how to stay in a safe horizontal position on the water surface.

Proposed Method

If a beginner is put into deep water early, even the first day of class, he gains a head start in overcoming his fear of deep water. It is proposed that beginning swimmers be started in deep water and put into every possible position and moved in every conceivable direction before attempting orthodox stroking. The instructor attempting this method should be experienced enough to know what happens to bodies in various positions and to anticipate typical reactions of students and varying degrees of fear.

Procedure

The students should be told the philosophy behind this procedure and given a brief overview of the motor skill sequence to be utilized.

Work should always be done in pairs with one partner constantly ready to assist the performer. Class can be started with the students sliding in along the gutter or handrail at the deep end of the pool. Have them extend their arms and allow their faces to go in the water, continuing to hold onto the gutter. Correct breathing techniques should be taught at this point. To vary the lesson, intersperse breathing practice with the technique of letting go of the gutter and sliding to the bottom of the pool, keeping the hands on the wall. Since few will be able to reach the bottom, it should be pointed out that the water tends to hold up a person. Teach students to submerge by kicking as high out of the water as possible, then kick back to the surface. When students can do this 25 to 30 times in succession, have them do the same thing at arm's length from the wall.

At this point, it may be helpful to go to shallow water long enough to learn a balanced float on front and back with a flutter kick to provide locomotion. When working again in deep water, have each student, one at a time, push away from the wall, lean forward, and kick back to the wall. Emphasize that the head must be brought well forward and the hands scooped from back to front at hip level. When this can be done easily, demonstrate a harder push from the side and use a pole to assist the student in case of difficulty in getting back. Care must be taken to avoid frightening the students. It may be wise to pull one or two of the better students in with the pole so the class can see what it is like. Then have students, one at a time, push far out from the side, lean forward, and kick back.

Working as rapidly as students' abilities permit, have them get into every conceivable position and move in every possible direction in deep water. This should include bobs, surface dives, forward and backward somersaults, log rolls, tub turns, oysters, and dolphins. Also skills are performed near the pool edge so that little effort will bring the performer back to his partner. Form is of little consequence.

Obviously, the class size must be reasonably small, preferably no more than twenty girls. This is to ensure each student's safety and provide a close student-teacher relationship. These factors are vital in helping the student overcome her fear. In a few cases, students were not able to let go of the gutter for such a long period that the rest of the class was held back. However, if an assistant can work with these few exceptions, the rest of the class can progress rapidly at their individual speeds. With the wide variety of skills to be learned, everyone can be challenged.

When all of the elementary skills are mastered, instruction in the standard swimming strokes may begin. The results of this method of

introductory instruction have been nothing short of amazing and students enjoy doing their "tricks" long after class. It has also been observed that during this program fewer girls miss class since they are having such a good time.

Add Bobbing Fun to Your Swimming Program

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Bobbing in some form or variation is a technique that most aquatics teachers consider a necessity in their swimming programs. It allows a swimmer to gain aquatic breathing skill, body control, knowledge of varying depths, awareness of kinesthesia in the arms, and establishes an "at-home-feeling" in the water. Coaches have considered bobbing essential because it serves as a warm-up for the training period.

Bobbing is a vertical downward-upward movement of the extended body in the water. The arms supply the power for bobbing. There should be two 180-degree power-press movements of the arms; one up and one down. *Power-press* is a concentrated displacement of water to enable a person to force water in one direction in order to move in the opposite direction. No sculling with the arms nor kicking with the legs should be used. Inhalation occurs at the top of the upward movement; exhalation occurs throughout the remainder of the skill. The rhythm is an even two counts. The tempo depends upon the depth of the water; the more shallow the water, the faster the rhythm, and vice versa.

Once basic bobbing has been learned, further challenges and thrills from executing this skill usually cease unless some new variations are introduced. *This is when the fun begins!*

Partner Bobbing

In six to eight feet of water, partners face each other, hold hands, and bob. While one is up, the other is down. The partner underwater should give a slight push from the bottom to gain the necessary momentum for the movement. Other than this push, all movement is caused by pulling on the partner, not by kicking with the legs.

Bobbing with Twists

In eight to ten feet of water, begin as for basic bobbing, but on the way up, just before the head breaks the surface of the water (extended arms are now at hips), position the hands at a right angle to the body with the fingers facing in the desired turning direction. Power-press water with the palms in the opposite direction, keeping the arms close to the body. The head and shoulders should turn in

the direction of the twist, with the eyes looking for the designated guide spot to terminate the half or full twist (180 or 360 degree turns). The extended body must be in good posture so that the twist will be effective. The rhythm is still the steady dual rhythm, but the upward count is divided in half, the latter half being used for the twisting action.

Progressive Bobbing

The downward movement is the same as in basic bobbing. When the bottom is reached, a slight squat is assumed (arms extended overhead). The body and arms lean forward to a 65 degree angle. Push easily from the bottom and stretch the body to an extended position until the surface is reached. Arms then circle backward and downward to the hips to bring the body back to a vertical position for the next downward direction. The rhythm is still a steady dual rhythm, but both counts are divided. Count "1 and" for the downward direction plus the time for the angle squat position; count "2 and" for the upward direction plus time to assume the vertical position.

Bobbing, Tuck Position, and Open (Inverted Kip)

Using sculling to hold the body in a vertical position, draw the knees to the chest (toes depressed). Then drop the extended arms to the sides and begin exhalation. Power-press the arms upward and extend the legs to the bottom keeping the body in good posture (head, shoulders, hips, and ankles in plumb line position). Return to the surface as in the basic technique. Rhythm is the basic two counts plus two counts to draw the knees to the chest. A variation adds half or full twists during the upward phase.

Bobbing Somersaults

Begin the downward movements as in basic bobbing. As the feet touch bottom, execute a somersault, tuck position. Return to an erect squat position with the feet on the bottom and the extended arms overhead. Then continue with the basic upward movement. The rhythm would be: Count 1, downward direction; count 2, tuck position; counts 3 and 4, turning period; count 5, erect squat position with arms overhead; count 6, return to surface. Somersaults could be done either forward or backward, or in an alternating combination. Variations would add a half or full twist during the upward phase or a tuck position at the surface.

Begin with the Elementary Backstroke

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In America we tend to consider the crawl as the standard or basic swimming stroke. It is fast, efficient, powerful, and evenly rhythmical. Because of this it is frequently the first stroke taught to the non-swimmer. This may be a very unfortunate choice, for however simple the coordination of the crawl may be for the swimmer, it is a difficult stroke for the non-swimmer.

Until one has learned to relax and be comfortable in the water, the alternating tension and relaxation of the legs during the flutter kick is a very difficult coordination to master. The beginner's constant tension will usually prevent her from making good progress through the water with the flutter kick. Rolling the face in and out of the water is another problem for the beginner who believes that every droplet of water is aimed for her tightly srewed up eyes or nose. One is forever battling the beginner's tendency to hold her breath throughout her stroke as a means of combatting this problem. The arms will not present too great a problem, but with so much else to concentrate on and worry about, the student will tend either to thrash them about or to wear herself out with a stiff arm recovery. The non-swimmer is not sufficiently aware of her limbs and their place in the water to exert tension with one limb and relax with the other. Thus, although the crawl is the standard stroke, the problems it presents to the beginner are very great, and a non-swimmer may spend weeks working on the crawl before she can master it well enough to swim 25 yards. It must be noted here that we are talking about the majority of non-swimmers, those who enter the pool rigid and afraid, not the little children or the rare teenager or adult who have no fear and are consequently relaxed in the water.

Consider instead the virtues of starting the non-swimmer with the elementary backstroke. One of the best attributes of this stroke is its simple coordination. Both arms and both legs move simultaneously. The beginner can concentrate on relaxing and driving, knowing that all four of her limbs relax at the same time and drive at the same time. The instructor can cue her verbally as she is swimming, something not possible in the crawl, when the word "pull" or "drive" also means to relax the other limb. The tendency to be rigid

during the recovery phase can be much more easily overcome than that same rigidity in the crawl, because the swimmer can concentrate on relaxing without having to think of anything else, and because the arms, reaching up through the water as the legs recover, tend to underscore the principle of making as little resistance as possible during the recovery. The pressing of all four limbs toward the body, at the same time, is the simplest coordination of the drive that could be invented. Remembering to glide is sometimes a problem, but the teaching of it works in nicely with teaching the rhythmic breathing sequence. The student is taught to rest while breathing in. To glide and breathe in, stroke and breathe out, is so nearly a natural impulse that the student will be able to learn to breathe rhythmically with a minimum of effort. There remains one real problem for the beginner to overcome with this stroke, and that is the splashing of water in her face due to improper recovery of the arms. However, she will be able to correct this herself as soon as she is made aware of the cause and effect action.

Because of the simplicity of the elementary backstroke, it can be learned in a relatively short time. With three or four classes at the maximum, almost all non-swimmers should be able to easily swim a 25-yard pool length doing the elementary backstroke. The psychological effect of this is tremendous. The student, knowing that she can swim and cover a distance through the water, loses about 90 percent of her fear. With a little urging she can be taught to jump into deep water and actually swim there (under careful supervision of course). Her self-confidence is boosted tremendously, as is her confidence in you as her teacher.

First of all, and by far the most important for her future learning, she can relax in the water because she is psychologically more at ease and has kinesthetically learned the principle of relaxing her limbs during the recovery of a stroke. She has become used to the water and has learned to balance her body on the water. She has learned how to propel herself through the water.

The student is at this point ready to attempt the crawl with a backlog of fundamental skills. The skills she now possesses, taught through the crawl stroke, would only be acquired after a much longer period of struggle in the water, during which time the student must also struggle with the problem of keeping the water out of her eyes and nose. The ease with which she will learn these skills through the elementary backstroke will provide a strong motivation for her to move on to the more demanding strokes.

Principles of Physics applied to Swimming

DWGS AQUATICS GUIDE COMMITTEE 1963-1965

The following article was developed as a result of the preliminary work done by this committee as it began the Stroke Analyses Project. The material contained herein provided background information and a point of view in approaching the stroke analyses. Iris Garland deserves special credit for her work on this article.

There is no one way to swim a particular stroke. Differences in body build, buoyancy, strength, and flexibility will influence what is the most efficient form for any one swimmer. It is the hope of the DGWS Aquatics Guide Committee that the following principles will be applied to all strokes so that swimmers may find their individual styles within the framework of efficient swimming.

The achievement of "form" in swimming strokes as in other sport activities has often been influenced by the particular styles of successful competitors. Frequently these styles are imbued with unnecessary idiosyncrasies or are especially suited to individual body characteristics. Also, the purposes of the competitive swimmer often vary from those of the recreational swimmer. However, the application of certain principles of physics to movement in the water will be the guide to efficient swimming, and therefore, good form whether for competitive or for recreational purposes.

Efficient swimming will be considered that which produces the maximum result with a minimum effort. Let us consider briefly the factors contributing to efficient swimming, which cannot be considered separately. It is the interplay of all of these factors which ultimately influence what is efficient for any one swimmer. Scientific study of this interrelationship is still under way; hence, current stroke analyses are theoretical and subject to change as greater understanding is gained.

I. BUOYANCY

Archimedes' Principle is "A body submerged wholly or partially in a liquid is buoyed up by a force equal to the weight of the liquid displaced."[1]

[1]Hausman, Erich and Slack, Edgar P. *Physics* Princeton, N.J.: Von Nostrand Co., Inc., 1957, p. 173.

Buoyancy will be affected by a change in specific gravity (weight per unit volume). Specific gravity can be changed by increasing the volume of air in the lungs (increasing the volume of water displaced), which makes the individual more buoyant. Specific gravity can also be changed by changing the relative proportions of fat, bone, and muscle in the body. Increasing the fat would increase the buoyancy.

At rest, the position of the body in the water is determined by the relative positions of the center of gravity (point around which gravitational forces are balanced) and the center of buoyancy (point around which buoyant forces are balanced). These centers assume a vertical line just as a picture hanging by a single nail will turn until its center of gravity is directly below the supporting point. Moving the arms beyond the head (but still in the water) raises the center of gravity and causes a more horizontal floating position. Ability to maintain a horizontal position in the water during stroking is important inasmuch as it reduces resistance to motion and permits more efficient application of force.

II. FORCE

Newton's Laws of Motion affect the efficient application of force.

1. "A body at rest remains at rest, and a body in motion continues to move at a constant speed along a straight line, unless there is a resultant force acting upon the body." [2]
2. "The acceleration of a body takes place in the direction of the resultant force acting upon it; the acceleration is directly proportional to the resultant force and inversely proportional to the mass of the body." [3]
3. "For every action, there is an equal and opposite reaction, and the two are directed along the same straight line." [3]

Muscular Effort

The force that moves the body through the water is produced by muscular effort. Force can be increased by utilizing more muscle fibers, by activating more muscle groups, or by substituting stronger muscle groups.

Cross-sectional Area

The larger the cross-sectional area pushed against the water during the propulsive phases, the greater the force produced. For example,

[2] *Op. cit.* p. 48.
[3] *Op. cit.* p. 49.

in the breaststroke kick, the legs and feet, rather than just the soles of the feet, are pushed against the water during the propulsive phase.

Direction

According to Newton's third law, the body will move in the opposite direction from that in which force is applied. It is most desirable to exert a propelling force directly backward to produce forward motion. However, because of the rotary action of body segments, this is not easily accomplished by the human body. Most propulsive movements produce both desirable and undesirable components of force. The problem is to increase the former while decreasing the latter. That is, during the propulsive phase of any stroke, force should not be exerted when the direction of force would result primarily in upward, downward, or sideward movement. In the front crawl, these *errors* are shown respectively in the following examples:

1. Beginning the pull, with straight wrist, directly downward from the surface of the water.

2. Finishing the push with the hand horizontal rather than vertical.

3. Crossing the hands in front of the head on entry and then pushing sideward.

Duration

Force is also dependent upon the distance through which the segment is carried in the desired direction, and the number of repetitions within a given time period. The ability of the individual to continue the activity over an extended period of time is dependent upon energy expenditure, muscular endurance, cardiorespiratory efficiency, relaxation, and psychological factors. The energy expenditure required to maintain a constant speed should be less than that required to create a varying speed. [4]

Speed

The faster a body part moves through the water, the more resistance it encounters, providing all other factors can be kept constant. For example, the arm pull in the crawl will be more effective if done more rapidly, providing the cross-sectional area and direction are kept the same. However, if the cross-sectional area is

[4]Karpovich, P. V. and Pestrecov, K. "Mechanical work and efficiency in swimming crawl and back strokes." *Arbeitsphysiologie* 10:504-14, 1939

reduced, it may be possible to move the arm back faster but with less resistance.

III. RESISTANCE

Resistance is both friend and foe to aquatic movement. Propulsion is dependent upon it, while forward momentum is retarded by it. The latter resistance must be minimized by streamlining body position, relaxing in the recovery phase of the stroke, and eliminating useless motions and tensions so that forward momentum will not be hindered.

Density

Because water has more density than air, it provides greater resistance to movement than air. Thus, propulsive movements are more effective when directed against water, and recovery movements should be performed through air when practicable (i.e. out-of-the-water recovery phases of crawl, backstroke, and butterfly stroke).

Cross-sectional Area

Whereas an increase in cross-sectional area is desirable during propulsive movements, just the opposite is the case in all non-propulsive movements. For example, the arms in the elementary backstroke are recovered close to the body with the forearm and hand following the upper arm during the first part of the recovery in order to minimize cross-sectional area and resistance.

Speed

Resistance is approximately proportional to the square of the velocity. Thus, the faster a body part moves through the water, the more resistance is encountered. Therefore, during the propulsive phase of the stroke, speed is desirable in propelling body parts, but movements of body parts should be performed more slowly during the recovery phase.

Shape

An irregularly shaped object has greater resistance to motion through a fluid than one with a gently curving surface. The more streamlined the position maintained by the body, the less resistance during forward momentum. For example, a breastroke glide with hands together may have less resistance than a glide with hands apart. However, the legs are kept slightly apart during the breastroke glide to reduce the eddies which form between the legs. The

difference is caused because the arms lead and the legs follow in the larger area already disturbed by the passage of the body. As long as the legs are not more separated than the width of the area disturbed by the body, each leg separately is more streamlined than the two would be together. However, the hands together provide a smoother shape for passage of the head and shoulders into relatively undisturbed water.

Waves

Motion which creates waves tends to increase resistance. As speed increases, a wave is formed in front of the swimmer's head, increasing the resistance which must be overcome. This may be a factor which will ultimately limit the speed that human beings can attain in the water.[5]

Surface

The larger the underwater surface, the greater the resistance (all other factors remaining constant). The size of the underwater surface, related to buoyancy and body structure, cannot be greatly altered in swimming without undue expenditure of effort. The texture of the bathing suit worn and even body hair may add resistance; competitors combat this by wearing nylon tank suits and removing body hair.

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[5]Alley, L. E. "Analysis of Water Resistance and Propulsion in Swimming Crawl Stroke." *Research Quarterly* 23:253-70, October 1952.

Stroke Analysis: Breaststroke

DGWS AQUATICS GUIDE COMMITTEE 1963-1965

The breaststroke analysis and the side stroke analysis were developed in response to requests for guidance in judging form swimming. In the 1967-1969 DGWS *Aquatics Guide* the announcement was made that form swimming had been eliminated from the rules as a competitive event.[1] In 1968 the American Red Cross published a new *Swimming and Water Safety* text[2] and altered many previous statements concerning the breaststroke and side stroke. This change created a need for swimming instructors to analyze why they are teaching specific facts and concepts as aspects of these strokes. Although the following articles no longer meet the need for which they were developed they retain their value for the swimming instructor.

A Guide for Viewing and Teaching the Breaststroke

Rhythm

There should be a rhythmic coordination of arm and leg movements. In general, the propulsive action (that part of a movement which moves the body though the water) of the arms should alternate with the propulsive action of the legs. Individual variations in timing are possible, but the propulsive actions of arms and legs should not coincide. Breathing should be rhythmically coordinated into the whole stroke, but inhalation does not have to occur in every stroke cycle.

Relaxation

There should be evidence of relaxation as shown by absence of extraneous movements, stability of body position, smooth controlled movement, ease in breathing, and ability to sustain the stroke for a reasonable period of time.

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[1] Division of Girls and Women's Sports *Aquatics Guide.* Washington, D. C. 20036: July 1967-July 1969, p. 140.

[2] American Red Cross. *Swimming and Water Safety.* Washington, D. C. 20006: The Association, 1968.

Power

The frequency with which the stroke is repeated shall not be considered, but there should be evidence of efficient movement of arms and legs resulting in movement of the body as a whole through the water. The duration of the glide should be sufficient to permit the swimmer to take advantage of the momentum developed by the power phase of the stroke. A nearly uniform propulsion of the body through the water is desirable; constant forward progress should be discernible at all times. No set guide can be given for the relative contribution of arms and legs to total power since individual variation may occur.

Form

Form shall include body position, head position, movements of the arms, and movements of the legs.

Body Position

Ideally the body position should be as nearly horizontal as possible. The body should be supported by normal buoyancy, not by downward effort of the arms or legs. The body should be as streamlined as possible. Little disturbance in body position should result from the action of the arms or the legs or from breathing.

Head Position

The head should be in line with the body but with hyperextension in the neck. During inhalation as little disturbance as possible should occur in body position. The exact position of the head in the water will vary according to the buoyancy of the individual in order to keep the ideal body position.

Arm Action

Both hands must be moved forward together from the breast under the surface of the water and brought backward simultaneously and symmetrically. Individual differences in strength, flexibility, buoyancy, and preference may result in arm strokes which vary from a relatively wide (more horizontal) pull with elbows nearly straight to a deeper (more vertical) pull combining a bent elbow with inward rotation (a turning movement around a long axis in which the front of the bone turns toward the middle of the body) at the shoulder joint. Some lateral separation of the hands should occur, however.

Leg Action

The legs should execute identical movements simultaneously and in the same plane. The legs must be drawn up simultaneously with

the knees bent and apart. The movement shall be continued with a rounded outward backward sweep of the feet and shall finish with the legs coming together. Individual differences will result in varied patterns. Confusion in terminology on breaststroke kicks makes names almost meaningless. Variations may include kicks in which, during the beginning of the propulsive phase, the knees are closer together than the heels, as well as the reverse. Recovery movements should create little resistance, and propulsive movements should exert maximal backward components of pressure. Does the action contribute to forward propulsion? Does it provide a large backward pressure during the propulsive phase and a minimum of resistance during recovery?

COMMON FAULTS, THEIR RESULTS, AND TEACHING SUGGESTIONS

Faults in Body Position	Results
1. Head too high	1. Hips and legs drop, resulting in increased resistance.
2. Head too low	2. Increased resistance of head and shoulders is caused by poor streamlining. Hips may break the surface of the water, creating waves and increasing resistance. Breathing is made more difficult by necessitating greater head lift when inhaling.

Teaching Suggestions

1. Hold the forehead at the water surface.
2. To see where you are going, use movement of the eyeballs rather than movement of the entire head.
3. Keep heels and hips just below the surface of the water.
4. Keep the back flat rather than arched.

Faults in Arm Action	Results
1. Very shallow pull.	1. If the pull breaks the surface of the water, the force is less effective since water is denser than air; additional force is lost in wave formation. If the pull does not break the surface of the water, force may still be lost in forming waves.
2. Elbow leads during pull	2. Power is lost due to a smaller portion of the arm producing forward

	propulsion—i.e. decreased cross-sectional area.[1]
3. A downward push of arms or hands	3. Body is lifted; effort used to cause lift does not contribute to forward propulsion.
4. Failure to bring hands toward midline before returning them to glide position.	4. Increased resistance during recovery is caused by less streamlining.

Teaching Suggestions

1. During the pull, feel the resistance against the hands and arms and the backward displacement of the water.
2. Slide the hands back to the position of the start.

Faults in Leg Action	Results
1. Failure to turn feet out before power phase	1. Loss of power is caused by smaller portion of feet producing forward propulsion—i.e., decreased cross-sectional area.
2. Ankles in plantar flexion at beginning of power phase	2. Same as 1.
3. Knee extension completed before hip adduction[2] is completed	3. Loss of power is caused by decreased backward component of pressure and increased sideward component of pressure.
4. Feet kept close together until maximum hip and knee flexion have occurred.	4. Delay in reaching position for propulsive action increases proportion of nonpropulsive action.
5. Recovery done too rapidly	5. Increased resistance is caused by speed of action.

[1]The cross-sectional area is the effective size of the body part. It may be likened to the two-dimensional area of the body part as seen in photograph taken by a camera placed directly in front of the swimmer. The smaller this cross-sectional area, the less resistance it has (all other factors remaining constant). Propelling movements must encounter a resistance to push against in order to propel the body through the water.

[2]Adduction in the hip joint is a movement which moves the leg from a straddle position to a normal standing position – i.e., toward the midline of the body.

6. Asymmetrical knee positions such as one knee turned in and one knee turned out (a form of scissors kick)	6. Illegal kick; disqualification.
7. Asymmetrical ankle positions such as one ankle flexed and one ankle extended at beginning of propulsive phase	7. Illegal kick; disqualification.
8. Too much hip flexion	8. Increased resistance is caused by larger cross-sectional area and loss of streamlining.

Teaching Suggestions

1. Keep knees pointing toward the bottom throughout the kick. This is a good correction if there is a tendency to scissor.
2. If tending to scissor, try turning the inward knee out.
3. Feel the correct ankle position (flexion and pronation) before beginning the propulsive phase of the kick.
4. Flex the ankles as you flex your knees. Keep the ankles and knees flexed as the feet slide apart.
5. Toes should point to the bottom of the pool at the end of the recovery and beginning of the propulsive phase.
6. Ankles should flex during the end of the recovery and remain flexed during the beginning of the power phase, but ankle extension should occur during the middle and end of the propulsive phase.
7. Draw the heels up just under the surface of the water during the recovery.

Faults in Breathing	Results
1. Taking too long to inhale	1. Body position and rhythm of the stroke are upset. Feet drop and increase resistance. Arm power is used for support rather than for propulsion.
2. Lifting shoulders and upper chest out of water during inhalation	2. As in 1, plus bobbing motion (sinking below normal floating level between inhalations) results in increased resistance.

3. Breathing too late (after propulsive action of arms)	3. Rhythm is upset. A delay in arm action or a downward push of the arms may be required to support the head above water. Effort used for support does not contribute to propulsion.
4. Holding breath and breathing out too little air	4. An inadequate exchange of oxygen and carbon dioxide results in fatigue.

Teaching Suggestions

1. Inhale as you pull; exhale as you kick and glide.
2. Face should be in the water by the time the hands are together.
3. Head should not move backward to breathe; chin is extended forward, and breath is taken in trough behind bow wave.
4. Head should move in "yes" action.

Faults in Coordination	Results
1. Arms and legs propel at same time	1. Uneven propulsion results in greater expenditure of energy. Body position may be upset, causing feet to drop and increase resistance.
2. Arms pause at end of propulsive phase	2. Increased resistance is caused by less streamlined position and greater cross-sectional area. Legs may drop, resulting in increased resistance.

Teaching Suggestions

1. Pull and breathe, then kick into a glide.
2. For beginners, hold the thumb of one hand with the other hand during the recovery to remind the arms to wait until the kick is completed before starting the next arm pull.
3. Practice one arm pull and recover to glide, then one kick and glide to learn the feeling of alternating pull and kick.
4. Begin and end each stroke in the glide position. In learning, prolong the glide position to get the feeling of the proper coordination.
5. Chant to yourself: "Pull, kick into glide." Swim to your own chant.

Stroke Analysis: Sidestroke

DGWS Aquatics Guide Committee 1965-1967
Stroke Analysis Project

A Guide for Viewing and Teaching

Rhythm

There should be a rhythmic coordination of arm and leg movements. Individual variations in timing are possible, but in general, the propulsive action starts in the lower arm and is transferred to the upper arm and legs. A glide, continuing until forward momentum begins to decrease, follows the propulsive phase of the stroke.

Relaxation

Evidence of relaxation should be shown by the absence of extraneous movements, stability of body position, smooth controlled movement, ease in breathing, and ability to sustain the stroke for a reasonable period of time.

Power

The actual speed with which strokes are repeated shall not be considered, but there should be evidence of efficient movement of arms and legs resulting in the movement of the body as a whole through the water. There are two essential power phases in the stroke: the minor phase or pull of the lower arm, followed by the major phase or pull of the upper arm combined with the press of the legs. This major phase is followed by a definite glide.

Form

Form shall include body position, head position, movement of the arms, and movement of the legs.

Body Position

The body should be in a streamlined side glide position. The body angles gently downward from the head to permit the kick to be entirely executed just under the surface of the water. The body should be supported by stroke momentum and normal buoyancy, not by downward effort of the arms or legs. Little vertical disturbance in body position should result from the action of the arms or legs.

Head Position

With the head supported by the water and the neck relatively relaxed, the neck is rotated slightly. The degree of neck rotation is variable and dependent upon individual floating characteristics, but the head and neck should not be moved for breathing.

Lower Arm Action

From a fully flexed palm down position with the arm in line with the body and at or just slightly under the surface of the water, the lower arm pulls down from the shoulder. Rotation at the elbow permits the arm to be angled slightly during the pull. Variations in elbow and wrist flexion occur as the palm and forearm press water toward the feet. The pull should be kept as close to the body as possible, ceasing when the arm is approximately perpendicular to the shoulder. The arm recovers by flexing up toward the lower shoulder, with fingers leading, then extending forward under the head to rest in the starting position. This should be accomplished with minimal resistance.

Upper Arm Action

From a fully extended, palm down position, in front of or lying on the top thigh, the hand, with elbow flexing, moves diagonally across and close to the chest to a position which may vary from a point near the lower shoulder to a point near the chin. The forearm is rotated to permit the palm to press water toward the feet as the entire arm pulls down, back to the upper thigh. Power results from controlled elbow extension combined with slight shoulder abduction. The pull is kept close to and parallel with the front of the body. The elbow extends during the pull, reaching full extension by the time the hand reaches the thigh to rest.

Leg Action*

From a fully extended side position and by means of hip and knee flexion, the heels are drawn toward the hips. To decrease resistance, this recovery movement should be kept as much in line with the midline of the body as possible, and within the water disturbed by passage of the cross-sectional area of the body. Some lateral separation may occur at the knees during this draw, but the movement should be relaxed and without power. As a continuation of this drawing motion and with flexion continuing at the knees, the

**This description includes a regular scissors kick (top leg moving forward into position for power phase of kick) and an inverted scissors kick (top leg moving backward into position for power phase of kick).*

legs begin to separate. One leg reaches forward and one back of the midline of the side position. The toes of both legs lead in the reach. This results in extension at the ankle, flexion at the knee, and extension at the hip joint of the back leg; and flexion at the ankle, a continuation of flexion at the knee followed by extension, and flexion at the hip joint of the forward leg. During this reaching motion of the legs, some hypertension may occur in the lower spine, increasing pelvic tilt and permitting greater range of backward motion. The feet and legs should reach an equal distance forward and back of the midline of the side position and as far as muscular flexibility permits, but one hip must stay directly above the other. The power phase follows immediately and is the result of a simultaneous "pressing extension" of the legs. Power is initiated in the forward leg by strong ankle, hip, and knee extension. The back leg begins the kick with the ankle extended and the knee flexed and hip hyperextended, with power resulting from complete extension of the knee, reduction of hyperextension in the lower spine and extension of the hip joint. Both legs meet in a fully extended side position which is maintained during the glide, taking advantage of the propulsion caused by the power action of the arms and legs.

COMMON FAULTS, RESULTS, AND TEACHING SUGGESTIONS

1. **Fault: Failure to maintain side position.**
   Result: Breathing is difficult if too far on face. Legs break water if too far on back or face.
2. **Back rounded, hips flexed too much. Heels not as far behind body as knees are in front of body.**
   Legs will rest forward of center line of side position. Back will round even more, legs will swing forward more as kick is started. Impossible to get back leg back. Resistance increased because of larger cross-sectional area.
3. **Head held more vertically than horizontally to the surface of the water.**
   Extreme tension in neck and shoulders causes early onset of fatigue. Hips and legs drop, causing increased resistance. Necessitates use of downward force of lower arm to support head above water. Body may compensate by bending at waist.

Teaching Suggestions

1. Keep legs and hips just low enough to permit kick to be executed entirely under water.

2. Keep neck relaxed and head resting in the water directly above the lower arm.
3. When in glide position, keep lower arm fully flexed under head, top arm extended in front of or lying on the top thigh, and legs fully extended.
4. Maintain a dry face by rotating the neck and looking over the top shoulder.

Faults in Lower Arm Action

1. **Fault: Hyperextension of wrist during recovery.**
   Result: Palm pushes water against desired direction of movement, causes added resistance.

2. **A reach rather than a pull.**
   Force expended during recovery action rather than pull. Does not contribute to propulsion.
3. **Power applied immediately after recovery movement of arm. No Glide.**
   Lack of glide eliminates possibility of monentary relaxation. Inefficient because momentum developed is not utilized. Reduces effectiveness of next pull because it takes longer to catch up with relative speed of water.
4. **Arm too far below surface during recovery and glide.**
   Head and shoulders tend to drop. Resistance increased because of larger cross-sectional area. Range of power phase decreased.
5. **Palm presses water toward surface as hand moves up to shoulder.**
   A negative movement, increasing resistance. Upward pressure, if strong enough, pulls body down.
6. **The greater portion of pressure is applied down toward pool bottom.**
   Tends to lift body strongly. Body drops when pressure is released. Effort used downward cannot be used to propel forward.

Faults in Upper Arm Action

1. **Fault: Reaching too far up to position in front of face.**
   Result: Water splashed in face. Body may turn to prone float position. Timing upset.
2. **Reaching too far out to the side.**
   Body turns to prone float position. Following pull may be horizontal rather than vertical, resulting in excessive body roll and making breathing difficult. Progress will be in a zig-zag pattern.

3. **Arm fully extended and straight during pull.**
   Too large a non-propulsive component of force. End of pull is up toward surface, tending to drop head.
4. **Arm pulls past top thigh and back of center line.**
   Body tends to roll to back float position. Increased resistance because of a larger cross-sectional area.
5. **Failure to have palm perpendicular to desired direction of movement.**
   Less effective pull because of smaller cross-sectional area.

Teaching Suggestions

1. Try to feel the transfer of power from the pull of the lower arm to the pull of the upper arm.
2. Distinguish between the power and recovery phases of each arm action.
3. Use the lower arm to stabilize and control body direction, but avoid all "sculling" movements.
4. Make all recovery movements relaxed and as close to the midline of the body as possible.

Faults in Leg Action

1. **Fault: Knees separate too far apart vertically during draw or extension.**
   Result: Body less streamlined, water resistance increased. Probably not a true scissors kick.
2. **Knees draw up too far toward chest. Back rounded, hip flexion is extreme.**
   Both legs will be forward of center line during extension and pull. Resistance and cross-sectional area increased. Body balance may be affected.
3. **Both legs forward of center line of body at beginning of reach.**
   Pressure resulting from following pull will not be in desired direction. Body tends to move at an angle to desired direction.
4. **Power exerted during draw and reach phases, none during actual power phase.**
   Negative action, wasted effort. Water is pressed toward head, against desired direction of movement. Resistance increased.
5. **Legs cross at finish of power phase.**
   Body not streamlined during glide, resistance increased and power lost.
6. **Ankle and knee of forward leg extended during separation and beginning of power phase.**
   Water pushed out to side and toward head. Resistance increased. Foot not in position to apply backward pressure in power phase.

7. **Failure to extend ankle of forward leg at beginning of power action.**
   Propulsion resulting from this action is lost.
8. **Legs spread too far forward and backward on reach, and position held.**
   Legs usually fully extended in a tense position. Cross-sectional area increased unduly and body rolls toward forward leg.
9. **Forward leg lifts and foot moves up toward surface during recovery.**
   Foot may come out of water, body tends to sink. Initial part of power phase may oppose desired direction of movement. Probably not a true scissors kick.
10. **Failure to extend forward leg during pull toward center of streamline position.**
    Pull will not be as effective because of a smaller cross-sectional area during propulsive phase. The leg travels a shorter distance, causing a loss of power.
11. **Knee of back leg flexed throughout power phase.**
    Power action will not be as effective because force is not directed rearward.
12. **Failure to bend knees on draw.**
    Negative action, hinders forward movement by increasing cross-sectional area and resistance.
13. **Not separating the thighs and legs far enough during reach.**
    Power is lost because length of force arm is decreased.

Teaching Suggestions

1. On the recovery, emphasize drawing the legs toward the midline of the body so that the knees are as far in front as the heels are behind, keeping knees facing forward at all times.
2. Emphasize a comfortable and equal reach with both legs.
3. Emphasize a rhythmic and controlled up, around, and together movement of the legs.
4. Squeeze the legs together.

Faults in Breathing

1. **Fault: Failure to breathe rhythmically.**
   Result: Fatigue.
2. **Failure to exhale sufficiently in rhythmic breathing.**
   Amount of carbon dioxide in lungs increases with each failure to exhale and eventually causes feeling of breathlessness. Contributes to rapid onset of fatigue.

Teaching Suggestions

1. Breathing should follow a regular rhythmic pattern, suited to the individual swimming the stroke.
2. Have student count or talk aloud while swimming. You can't talk without breathing.

Faults in Coordination

1. **Fault: Top arm action is not simultaneous with leg action.**
   Result: Jerky, uneven progress which soon tires the swimmer. Increased resistance caused by lack of streamlining.
2. **Failure to relax and glide.**
   Contributes to early onset of fatigue.
3. **Glide too long, failure to effectively utilize momentum.**
   Jerky progress. Increases amount of force needed to begin next stroke because greater inertia must be overcome.
4. **Bottom arm propulsion occurs simultaneously with top arm and leg propulsion.**
   Jerky progress. Unbalanced position.
5. **Pull of lower arm and recovery of upper arm and legs is done simultaneously.**
   Uneven, jerky stroke. Reduces effectiveness of power.

Teaching Suggestions

1. Pull (lower arm), pull (upper arm) and kick, then glide.
2. Return to the glide position at the completion of each stroke.
3. At first, the stroking should be almost continuous. Only after balance and power is developed can there be any appreciable glide between strokes.
4. Forward momentum through the water should be as continuous as possible.

Teaching the Dolphin-Butterfly Stroke

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The dolphin-butterfly is a stroke familiar to all coaches of competitive swimming, but is often neglected in instructional programs. Unfortunately, many teachers have not learned this stroke and do not understand the mechanics well enough to develop an effective progression for presenting it in a class situation. The progression which follows has been used successfully by the author for a number of years to teach students of intermediate through advanced skill levels to perform the stroke in a few class sessions. The stroke timing developed in this progression allows the swimmer to perform in a very relaxed and restful manner. It does not lead to a sprint stroke; this would demand a slight modification of timing and depth of the kick.

It is recommended that the instructor practice this progression before presenting the stroke so that effective demonstrations of each step may be given and a proper feeling for the movements involved may be developed.

It will be observed that the acquisition of the skill is dependent, in part, upon the strength and endurance of the muscle groups in the upper back and shoulders which serve to lift *both* arms simultaneously over the surface in the recovery phase. Moreover, a lack of flexibility in the muscles across the front of the shoulders can inhibit the range of motion necessary at the shoulder joint.

Stroke Description

The stroke is begun in a prone position with the head and shoulders at the surface and the hips and legs dropped slightly below the surface. Both arms are in a forward horizontal extended position. As the arms press down and back against the water, the elbows are bent slightly to keep the pull under the body and to shorten the lever from shoulder to hand. As the pull continues, the elbows gradually straighten to direct the force backward as much as possible. Immediately after the full is completed, with the arms in extension at the sides, the recovery phase begins. The extended arms are lifted up out of the water and swung across and close to the surface to forward horizontal extension in the water. This completes one armstroke cycle.

In the dolphin kick the legs, functioning as a single unit, are held together and execute simultaneous up and down movements. The kick involves movements in the trunk, pelvic girdle, and legs which result in an undulating movement of the body. At the beginning of the downstroke the spine and hips are in hyperextension, the knees are flexed about 45 degrees, and the ankles are in plantar flexion. This downward-backward movement is initiated in the lumbar area of the spine and is transmitted down through the hips, knees, ankles, and feet. The end of the downstroke is similar to a whiplash. The spine goes from hyperextension to extension, the hips from hyperextension to slight flexion, and the knees from flexion to extension. The upstroke is initiated in the lumbar area and is transmitted through the hips, knees, ankles, and feet. The spine goes from extension into hyperextension, the hips from flexion to hyperextension, the knees from extension to flexion, and the ankles remain in plantar flexion. One complete kick is composed of the downstroke and the upstroke.

The popular dolphin-butterfly employs two complete kicks for each armstroke cycle with inhalation usually occurring on every other stroke. This two-kick stroke is called a "four-beat" stroke. The first two "beats" are the first downstroke and upstroke; the third and fourth "beats" are the next downstroke and upstroke. The movements of the legs henceforth will be referred to as beats.

Teaching Progression

Before the complete four-beat stroke is presented, skill should be developed in the performance of a two-beat stroke which employs only one full kick per armstroke cycle.

Phase 1. This drill produces almost no forward linear movement but develops the coordination of the arms and legs as they press against the water simultaneously. From a prone float position with the head held down, the entire body arches and the knees flex. The arms and legs press down against the water. The arms and legs are recovered slowly underwater to the arch position. Repeat this action as long as the breath can be held comfortably. Practice Phase 1 several times before presenting Phase 2.

Phase 2. Begin in the same starting position as Phase 1. The depth of the legstroke is maintained but the arms press back against the water in a full 180 degree sweep, stopping at the sides of the body. The arms and legs recover slowly underwater again to the starting position. Repeat as in Phase 1.

Phase 1

Arch

Press

Recover to Arch Underwater

Phase 2

Press Initiated

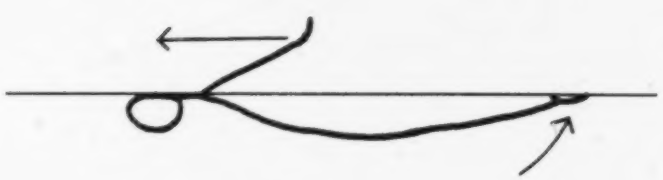
Press Completed

Recover to Arch Underwater

Phase 3. The underwater recovery of the arms in Phase 2 is eliminated here and the arms are lifted above the surface and swept forward to the entry position in front of the shoulders. The backs of the hands or little fingers should lead to prevent the elbows from bending and causing the upper arm to drag through the water. As the arms recover over the water the legs move through the upstroke (second beat). The body is now in the starting position once again.

Phase 3

Arm Recovery Initiated at Completion Leg Downstroke



Upstroke of Legs During Arm Recovery

Hand Entry at Completion of Leg Upstroke

Pause at this point momentarily before repeating the pull and recovery cycle. The head should be held down (as the breath is held) throughout several repetitions of this two-beat stroke. Continue practice of Phase 3 until proper arm and leg action is developed. This should be done very slowly, without regard to speed of forward motion or body position in relation to the surface of the water. After a few minutes, fatigue may be observed in the shoulders and the arms will not clear the water. In this case, wait until the next class session for presentation of Phase 4.

Phase 4. Rhythmic breathing may be introduced at this stage. Inhalation may be made by lifting the chin to the front or by turning the head to the side as in the front crawl. Each method has its merit. Competitors seldom breathe to the side because of the danger of dropping the opposite shoulder and consequent disqualification. By turning the head, however, the head remains partially supported by the water and less effort is required to take a breath. Whether the breath is taken to the side or in front, it should be taken as the arms are completing the pull and the legs are completing the downstroke. The breath should be taken every other stroke and should be deep and quick so that the head may be brought back into position *before* the arms are lifted out of the water for the recovery. A common error experienced by learners is that of holding the head up as the arms start to recover. In this situation the weight of both arms and the head causes the upper body to submerge and the hips to drop lower, destroying the desired horizontal body position.

This two-beat stroke with breathing should be practiced until it can be performed with ease for approximately 50 yards. To obtain maximum forward motion, continual emphasis should be placed upon backward, rather than downward application of force.

Phase 5. The two-beat stroke is now modified by the addition of a second kick. Because two complete kicks (four beats) must be performed in the time required for one armstroke cycle, the kick should be shallower with less knee bend than that used in the two-beat stroke.

In Phase 5 one complete kick is made with the arms remaining in the starting position. The arms do not pull until the second kick is started; at this time a complete two-beat stroke is performed and the body is again in the starting position. The first kick is delivered again while the arms are extended forward underwater. It is this "glide phase" with the first kick that allows the swimmer to conserve energy over a period of time. As more endurance is developed and more speed desired, the glide phase is eliminated and the arms begin pulling immediately after entry. To maintain balance and timing, the

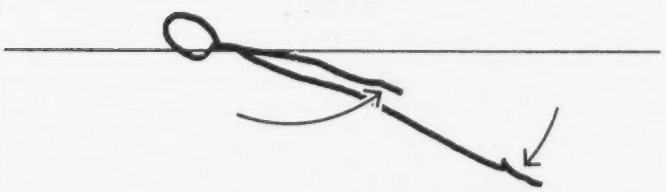
first part of the arm pull describes a circle similar to the arm pull of the conventional breastroke. This occurs on the first and second leg beats. The arm pull is completed on the third leg beat (downstroke) and the arms recover on the fourth leg beat (upstroke).

Phase 5

Hand Entry and Starting Position

First Beat

Second Beat



Third Beat and Inhalation to the Side

Fourth Beat and Arm Recovery to Starting Position

Swimming for Rehabilitation of the Physically Handicapped

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Fun and the chance to have a good time with others are universal needs of children, but when a youngster is literally tied to a wheelchair or laced into pounds of steel braces, the opportunities for play may be few and far between. Aquatic activities can provide a short period of freedom for these children. Water will sustain a body at or near its surface because of its density, and it is an ideal medium for the handicapped individual to participate in non-weightbearing activities or in activities in which the weight of the body or part of it is reduced to a minimum.

Rusk[1] has done considerable work in compiling disability data. He shows that nearly one out of seven Americans has a chronic or permanent health impairment. The estimated total of these persons is twenty-four million. Since a large part of our population is suffering from some type of handicapping condition, it is imperative that we examine our resources to determine what can be done to minimize the problem.

A person who cannot walk without the use of aids may be able to swim with considerable freedom. While learning or enjoying swimming in pleasant surroundings, the handicapped individual is generally so interested and absorbed in the experience that mental freedom from the disability frequently occurs simultaneously with physical freedom. And with this freedom comes the sense of "being like others." The psychological value of swimming for these persons who are often denied the opportunity to engage in an activity with others is often immeasurable.

The physiological values of swimming are also of great importance to the handicapped individual. One of the most common causes of poor circulation is lack of exercise. The handicapped person may not get adequate exercise because of a lack of balance. Swimming provides the opportunity to improve circulation through exercise; there is deeper ventilation of the lungs because of the activity of the subject and the pressure of the water on the trunk; it facilitates muscular control and coordination; it extends the range of motion from limited to full movement; and it progressively develops strength and endurance.

[1]Howard A. Rusk, "Rehabilitation Inventory," *The New York Times*, January 10, 1960.

Most pools have been built for normal persons. However, they can easily be adapted for use with the handicapped. One of the most common causes of poor circulation is lack of exercise. The handicapped person may not get adequate exercise because of a lack of balance. Swimming provides the opportunity to improve circulation through exercise; there is deeper ventillation of the lungs because of the activity of the subject and the pressure of the water on the trunk; it facilitates muscular control and coordination; it extends the range of motion from limited to full movement; and it progressively develops strength and endurance.

Since each handicapped person has his own special problems, it is not the author's intention to attempt to give specific content for programs for teaching of the handicapped. However, Daniels[2] states certain beliefs regarding instructional methods which will be helpful to those starting a program for the handicapped.

1. The group method of instruction should be used when possible. It should be supplemented by individual instruction when necessary.
2. The instructor should use a wide variety of teaching aids and equipment in capturing and holding learner interest.
3. The instruction should be informal with periods of short duration.
4. The standard rules of health and safety should be observed and supplemented by special policies when necessary.
5. Students should be classified according to swimming ability. It is not necessary or desirable to classify for swimming in school situations according to type of disability.
6. The swimming period should represent a good balance between instruction and recreation.
7. Pleasure and successful accomplishment should result from each class experience.
8. The instructor must be alert and tactful to avoid situations that might be embarrassing, frustrating, or discouraging to the students.

A swimming program for the handicapped in the community is an excellent way for colleges and universities to provide physical education majors with experience in working with the handicapped. Many community agencies and groups have facilities available for starting such a program. The local American Red Cross chapter will provide instructional materials and training aids. They will also train instructor personnel and, if needed, can aid in obtaining pool facilities.

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[2]Arthur S. Daniels and Evelyn A. Davies. Adapted Physical Education, Second Edition. New York, New York: Harper and Row, 1965, 453-454.

Handicapped students for these classes can be reached through many agencies in the area, in particular, the health department. Once the program is started, requests for admission to the class will usually be above all expectations. Medical clearance is essential for each student before he is allowed to participate in the program. When the doctors in the are are contacted and are given an explanation of the program, they will probably be willing to cooperate. Cooperation with doctors and therapists working with the handicapped students in the program is necessary if optimum results are to be obtained in the rehabilitation of the individual.

In teaching the handicapped, one must remember that the disability should be considered not in terms of what others perceive it to be but what the individual thinks it is. The aim of the swimming instructor should be clear with regard to these students. He should provide the handicapped individuals with the opportunity to experience success. For many handicapped persons the opportunity to participate in the activities of normal persons is only a remote possibility, something to be wished for, but probably not possible. An aquatic program, if planned properly, might create the determination that could lead to the satisfactory rehabilitation of the individual.

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Diving

Techniques for Beginning Diving

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We are familiar with Head Start as a preschool program for youngsters who do not have advantageous home backgrounds. "Head first" is a childhood phrase we used as we swam in a creek or pond, a challenge to the beginner, a milestone when reached, and then a casual splash for any real swimmer.

Putting these two concepts together, I would like to propose a miniature Head Start diving program toward the goal of head first. The object for the beginner would be to prepare her for eventual diving instruction. The preparatory skills might include–

1. Comfort and assurance as a paddler in deep water
2. Treading in deep water for safety
3. Bobbing in deep water for ease of breath control
4. Ease and facility underwater, including the ability to stay under from six to ten seconds and to open the eyes freely
5. Experience in jumping feet first into both shallow and deep water for breath control, handling the sensation of explosion as one breaks the surface into the water, controlling body position through the water, learning contact with the bottom, and learning to push back to the surface.
6. Handstands in shallow water for experiencing the upside down position, practicing body control to maintain balance, and practicing breath control

Perhaps none of these skills should be *taught* in a literal sense. Many a six year old does not have to be told to exhale under water, open his eyes, or push off from the bottom. But it is desirable to check on those basic abilities which we often take for granted. We have our sights set for diving specifics and forget that the fears, hesitations, and obstinacies which often occur may stem, not from diving problems, but from a lack of basic aquatic skills which belong in the early stages of learning.

PRINCIPLES OF BEGINNER TEACHING

Suggested progressions for teaching a beginner to dive from poolside, float, or pier are uniformly similar. Any diving reference

presents almost identical material in pre-springboard instruction, based on the premise of starting close to the water and working up to a standing position. The basic techniques to emphasize with the beginner are 1) *the general principles directly related to all diving,* and 2) *the psychology of teaching beginners to dive.*

The general principles are ones that the student can and must *feel* from his very first lesson, namely, *alignment, balance,* and *focus.* These must be presented simply and logically in varying degrees of detail, according to the age of the student, class size, and physical environment (wind, temperature, and weather). The success or failure of the beginner will depend on how well these principles are communicated to him. He must recognize, understand, feel in himself, and begin to control his alignment, balance, and focus.

Alignment

This is the starting point for all physical activity—the most efficient static and dynamic lining up of the body sections through the joints. Starting with standing posture, concentrate on the proper strength and tone to stand tall, the elimination of improper tensions or shortened muscle tendon areas due to bad habits, and the intellectual frame of mind necessary to command good alignment. For the child beginner, hopefully only the intellectual aspect need be stressed. For adult beginners more work is needed to combat poor posture habits and increase muscle strength.

With proper supervision and instruction, alignment awareness and practice in standing and walking activities will carry over to other positions and motions.

Balance

This is not just the state of being in balance without motion, but the sensitivity to loss of balance (the beginning of rotation) and awareness of control of this balance. The student should ask himself these kinds of questions: "Exactly when do I lose my balance? Where is the point of no return? When do I feel exactly upside down? How does my balance change as I get under water? How can I control these positions?"

Focus

The relationship of sight to balance, direction, and control is important in any physical activity. In diving, focus is important at specific points within takeoff actions and the flight of the dive. Start by being sure that the beginner keeps his eyes open, since there is a common tendency to close them. The fact that the eyes are open is not enough; they must see, and see specific points. A blur of objects

passing by is confusing. After focusing on particular points, the diver judges and directs his actions according to her relationship to the things she is sighting. Thus we teach aim for entry by sighting a desirable "spot" on the water along the extended arms. Precede this by an upward aim on take off and the combination will begin to correlate with alignment and balance for a good dive.

OVERALL GUIDELINES

The specific stages of teaching beginners in diving, such as sitting, kneeling, and falling in, should be permeated with these basic principles. Early exposure to the concepts of alignment, balance, and focus does help the beginner to understand her own actions and contributes to her progress. The psychology of teaching beginners in diving is complicated by factors peculiar to diving. Two factors especially seem to magnify the experience: the willing of oneself to fall through the air (or get thrown through it by the springboard), and the change of element from air to water involving "hitting" the water. First sensations can be indelible. If you miss tennis balls on your first tries, you feel foolish and inadequate. If you lay out flat on the water, it hurts!

The beginning diver is faced with this new and strange experience of going through air into water. All beginners are not petrified with fear. At any age there will be some who enjoy the sensation from the start and welcome every new step. This occurs most frequently among children between five and ten years of age. Although teenagers, college students, and adult learners are more cautious, some will take to diving easily.

We must help those who are cautious and fearful to overcome their negative feelings and to enjoy whatever degree of mastery they can achieve, whether as competent poolside or springboard divers. The teacher must be meticulous, yet comprehensive; prudent, yet not so pedestrian in tempo as to lose the spark of imagination. The teacher must learn to distinguish between lazy students with lazy bodies and students who are sluggish because they are fearful; students who understand well, but have no command of their physical beings; and students who can progress quickly to the springboard.

There are unfortunate situations where beginning swimming programs succeed or fail on the numbers of swimmers who can be "passed." The basic head first dive is usually the last of the test items, and is often rushed, forced, or even omitted in order to qualify swimmers. A youngster can survive in the water and possess adequate skill without any knowledge or ability related to getting into the water head first. But the result of this neglect of beginning

diving instruction is a bad experience for that beginner and a poor prognosis for further diving interest. If diving is a part of the beginners' skills, it should be included as an integral part of the course. Honest teachers will abide by honest standards in proper teaching, practice, and evaluation of the dive.

Diving is not easy to teach, and is often not easy to learn. Individual capacity has a very wide range and is greatly affected by the student's current emotional state. This is a skill which is a fine combination of balance and quick decision, and is significantly influenced by frame of mind and condition of body. Patience, analysis, and more patience are required by both teacher and student.

The rewards for the diver are the satisfactions of accomplishment and the expansion of one's physical experience. The teacher's gratification comes from the awareness of having helped students overcome fear and hesitation to achieve new physical experiences, the successful communication of principles difficult to express, and the enjoyment of watching the evolution of skill.

Rebound Diving[1]

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With the advent of the trampoline, springboard diving can be practiced without water. Schools, recreation centers, YMCA's, private clubs, and many other groups that do not have swimming pools for indoor use now have a piece of equipment that will very handily substitute for water. This new and imaginative approach to teaching springboard diving has many advantages over actually diving into water. There are numerous safety checks one can use on the trampoline that would be very difficult, as well as hazardous, on the diving board. Since there are no adequate indoor diving facilities in our area, rebound diving has become a popular pastime for our divers. The only missing sensation is the wonderful feeling of plunging into cold water.

What does the future hold for rebound diving? This question is easy to answer in terms of skills learned, enjoyment, excitement, and dollars and cents. For those areas without indoor pools, the cost of one trampoline is small compared to the cost of an indoor pool.

Rebound diving is based on the use of the trampoline to teach springboard diving. The skills taught will have a direct relation to learning a specific dive and will not necessarily follow the prescribed teaching progression for rebound tumbling, although it would be a good idea to teach all the basic bounces.

Basic springboard work can be taught on the pool deck—that is, the approach, hurdle, take-off, arm action, back take-off with correct foot and arm action, etc. As a matter of fact, the take-off, both front and back, along with the correct foot and arm action, can be taught on the trampoline. The actual hurdle, with correct arm action, and front take-off can be taught on the bed, minus the approach. Both the three-movement and four-movement technique[2] for the back take-off are adaptable to the bouncing bed.

Basic skills such as the required dives may be modified and done on the trampoline. Since all dives are done either with a foot first or head first entry, some adjustments must be made, because no head first landings should be made on the trampoline.

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[1]Figures were drawn by Kathy Marcon from photos of Charles Stewart and Wayne Miller.

[2]Moriarty, Phil. *Springboard Diving.* New York: The Ronald Press Company, 1959. pp. 23-25.

The basic positions--tuck (T), pike (P), and layout (L)--are the first skills taught, along with basic landing positions, after the diver has adjusted to the feel of the bed.

On the trampoline, for all practical purposes, the back twisting somersaults are even twists, and front twisters are uneven. On the springboard, this action is reversed.

Twisting actions should always be in the same direction, both front and back, with the possible exception of the front dive one-half twist. Many divers find that if they do this dive in the same direction as the rest of their twisting dives, they have a tendency to over-twist, whereas, when twisting the opposite direction, they have a tendency to hold back, thereby having more control of the entry into the water.

Hurdle and Take-off (Figure 1)

The arm action and take-off begin with head erect and eyes on a spot on the trampoline. Without bending at the hips, the body is

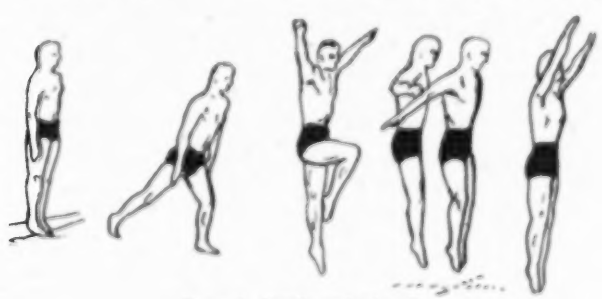

Figure 1. Hurdle and take-off.

lifted about 12 to 15 inches up and covers about 2 to 3 feet forward, with arms lifted side upward as hurdle leg is lifted, forming a right angle with the trunk and foot pointed down and at a right angle to the trampoline. While the free leg is rising to this position, the other leg is depressing the trampoline. At the top of the hurdle, the arms are fully extended above the head, with trunk up and body straight. As the diver drops to the trampoline, the bent leg is straightened and he lands with his arms brought downward on a lateral plane with the body without too much backward swing from the shoulders. The drop is made in almost a vertical plane with not more than 1 to 2

degrees of lean. The knees and hips are slightly flexed when the landing is made to take up the landing shock. As the trampoline is further depressed, the knees and hips cease to give and the full weight of the body settles on the trampoline. As the maximum depression is reached, the knees and hips begin to extend and push against the trampoline, causing the bed to depress further. As the trampoline recoils, the knees and hips continue to extend and push the body upward. As the body pushes upward, the arms swing upward and serve to control body balance and supply a further force in the depression of the trampoline and lift on take-off. The hands aim upward to the position necessary to guide the dive.

Back Take-off (Figure 2)

The three-movement technique[3] is the back take-off starting from a standing position with chest up, arms by the side, head in a normal position, and eyes fixed on a point somewhere on the bed of the trampoline in front of the diver. The feet may be together, or feet apart and heels together. The heels are level with the bed, but with the weight on the balls of the feet. The first movement is started by lifting the arms side upward to a point just above the head and pressing up onto the toes. At this point, the bed is depressed. As the arms are swung down in a slight clockwise movement and the knees are flexed, the heels drop down to trampoline level. When the

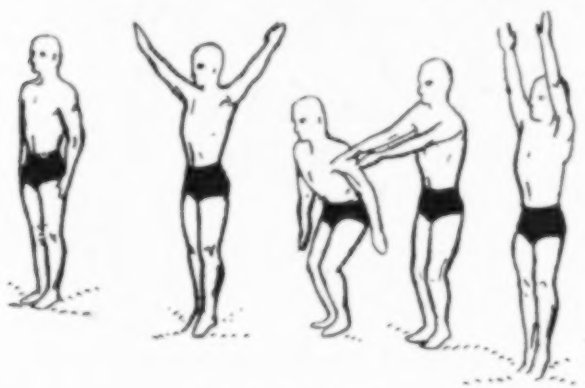

Figure 2. Back take-off.

[3] *Ibid.* pp. 23-25.

arms reach their lowest point, they are swung up in a more frontal position and the knees are straightened and the body begins its upward lift with full ankle extension. This, in a sense, is what you do each time you spring on the trampoline bed.

The four-movement technique[4] is the same, except for the starting position. This position is with the heels up and the diver balanced on his toes.[5] The first movement is to drop down to trampoline level with the feet, then pick up with the three-movement system. This system gives the diver more opportunity to set the trampoline in motion, giving more lift, which will enable him to do the more difficult back turning and twisting dives.

The angle of take-off should not be less than one degree for obvious reasons, and not more than ten degrees for both front and back take-offs. This angle of departure holds true for the trampoline as well as the springboard.

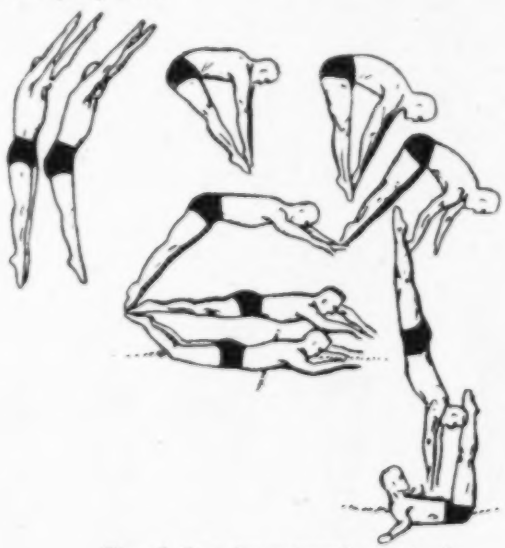

Figure 3. Front dive to stomach or back, pike.

[4]*Ibid.* pp. 23-25.

[5]Batterman, Charles. "Springboard Diving Part 3, Back Take-Off Dives." *Scholastic Coach,* December 1959. 44 pp.

Front Dive, Pike to Stomach or Back (Figure 3)

With a one-step approach and hurdle, the take-off is executed with arms extended overhead as the legs drive the body with a slight forward motion. The hips are brought up with the feet down and slightly forward with head up and eyes on the bed. The arms are then pressed down and the touch is made. From this point, one of two landings can be made, the first being a front drop, the other allowing the legs to ride up behind until the body is in a straight position and lined up for a head first entry. Just before the entry is to be made, the head is tucked under and a back drop landing is made. On this second type of landing, the leg lift is more forceful on take-off, the touch is straight down, and the eyes never lose sight of the bed until the landing is made.

Front Dive, Layout to Stomach or Back (Figure 4)

The same technique can be used here as in the front dive pike, except the body is kept straight all the way and the arms are spread out to a position straight from the shoulders with a slight angle forward. Either type of landing can be executed as in the front dive pike.

Back Dive, Pike (Figure 5)

Using either type of back take-off described earlier, the body is extended with the arms swung up to an overhead position with a slight lean backward. The arms are pressed slightly forward, but almost straight up, with the head in a slight chin down position. The legs are pressed upward to a pike position until the hands are reached in an almost perpendicular position with the bed of the trampoline. Caution should be practiced at this point not to lift the legs too fast because the landing position is on the back. After the touch is made, the drop begins and the diver lands on his back in an open pike position with the chin still tucked.

Back Dive, Layout (Figure 6)

In this dive, the body is kept straight with the head up. The diver executes a three-quarter back somersault to a stomach landing position. While in flight, the arms are spread laterally to a position at right angles to the body and the head is held at a normal erect position. At the top of the dive, the head is dropped backward and the eyes begin to look for the landing.

Inward Dive, Pike or Layout (Figure 7)

Using the back take-off and pushing the hips back, rather than forward, the diver then executes the front dive technique.

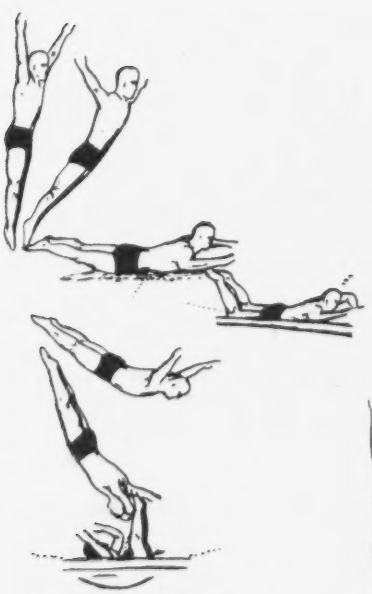

Figure 4.
Front dive to stomach or back, layout.

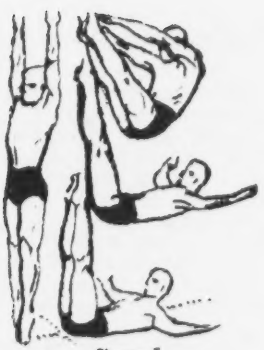

Figure 5.
Back dive, pike.

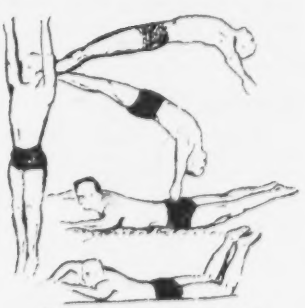

Figure 6. Back dive, layout.

Figure 7. Inward dive, pike or layout.

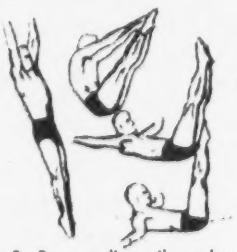

Figure 8. Reverse dive, pike or layout.

Reverse Dives, Pike or Layout (Figures 6 and 8)

Using the front take-off, pushing and lifting forward, execute the back dive, pike, or layout.

Front Dive, One-Half Twist, Pike (Figure 9)

Beginning with a front take-off, execute a front dive, pike position, with the idea of landing in a front drop position. After the

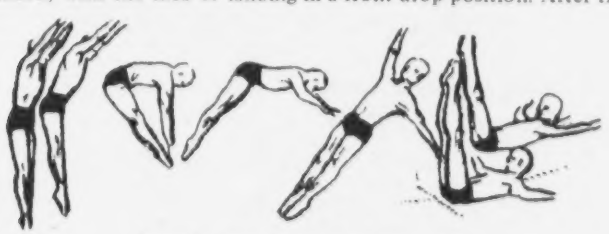

Figure 9. Front dive, one-half twist, pike.

touch is made and drop begins, the diver then executes a one-half twist by dropping one shoulder under the body and lands on his back in the same manner as the back dive, pike position.

Front Dive, One-Half Twist, Layout (Figure 10)

Again, using the front take-off, the diver begins this dive very much as though he were planning to do a front dive in layout

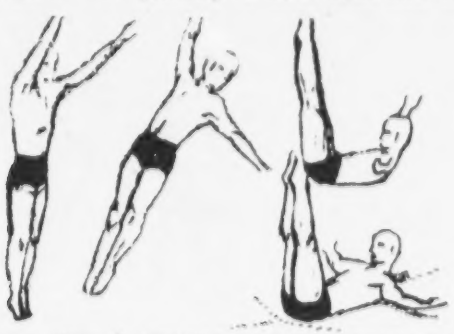

Figure 10. Front dive, one-half twist, layout.

position. As the body is lifted, one arm and shoulder is dropped so as to do a side dive. The diver looks down this arm towards the trampoline. The legs should not be lifted too fast. At the top of the dive, the twist should be one-half completed. At this point, two types of landings can be used. If the diver wishes to follow through much as he would on the springboard, he should lift his legs faster, drop his head back on completion of the twist, and look for his landing on the stomach. The other type of landing would simply be to bend at the hips after the twist is completed and execute a back drop.

Back and Reverse Layout Position (See Figure 11)

Front Somersault (See Figure 12)

The front somersault is first done by tucking the head under and landing on the back, then to a sitting position, and then to a stand. Using a hand spot, the diver can be made to feel more secure on the trampoline than on a springboard.

Figure 11. Back and reverse layout position.

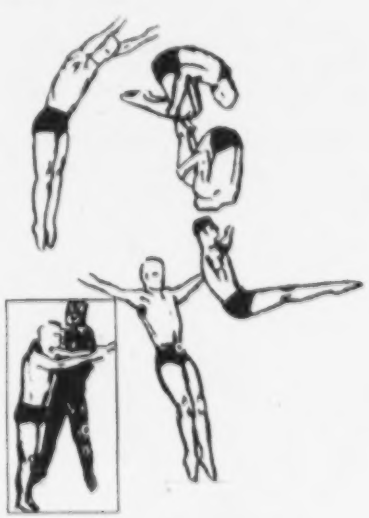

Figure 12. Front somersault. Inset: spotting front somersault.

The spotter stands on the bed of the trampoline with the diver. The left hand and forearm of the spotter is placed across the back of the neck and grasps the opposite (right) shoulder of the diver. This would mean then that the spotter is facing the diver's left side. This spotting procedure may be reversed.

Both spotter and diver begin to spring the bed together, with the spotter never actually leaving the bed, but keeping time while the diver lifts into the air. At a predetermined count, the diver begins the front somersault by lifting off of the bed with his hips up and the arms leading the way. As the hips lift up and the head and arms are thrown down, the spotter uses his arm as a point for the diver to pivot on. The less pressure is applied on the spotter's arm the more secure the front somersault becomes to the diver. The next step is to allow the diver to perform the front somersault without a spot, using a one-step approach with hurdle and take-off. It is not necessary to stress form and position at this time. As the skill becomes easier to do, then the form and position become very important. To progress beyond this point, the diver would continue the somersault action to the front drop position or completely to the back, doing a front one and three-quarter somersault.

Inward Somersault: Tuck and Pike (Figure 13)

The same technique is used here as in the front somersault. The big difference is in the push of the hips which in this case is up and back with the head kept erect until the bend is made at the hips. The body travels back and away from the take-off position. The take-off is that used for back take-off dives, using either the three- or four-movement technique.[6]

The inward one and one-half somersault would follow the same action recommended for the front one and one-half somersault.

Back Somersault: Back 1½ and Reverse Somersault and Reverse 1½ (See Figure 14)

Beginning in the center of the trampoline, the spotter and diver stand together with the spotter facing the left side of the diver. The spotter places her right hand on the back on the diver's neck, grasping it firmly, her left hand grasping the diver's shorts at the waist about in line with her left hip. As the diver begins to bounce, the spotter keeps time with the bounce but does not leave the bed. At a predetermined count, the diver swings the arms upward, head back, lifts the hips up and brings her knees to her hands. The spotter should assist by lifting the hips of the diver with the left hand and

[6]Moriarty, Phil. *Springboard Diving.* New York: The Ronald Press Company, 1959. pp. 23-25.

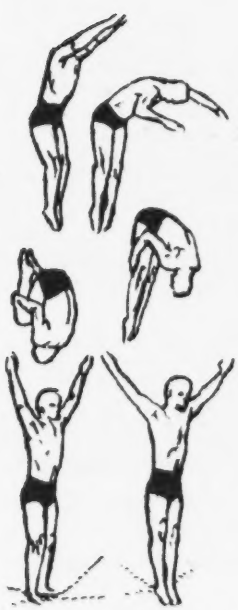

Figure 13. Inward somersault, tuck and pike.

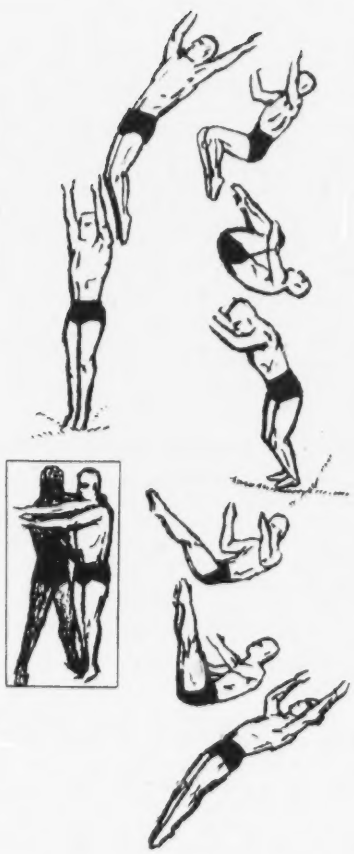

Figure 14. Back somersault, back and one-half; reverse one and one-half. Inset: spotting back somersault.

supporting her at the top of the somersault with the right hand. The spotter should have complete control at all times. As the diver improves, less support is given by the spotter until she can do without any help.

At this point, the diver should begin using the back take-off described earlier. To execute the back one and one-half somersault, the diver would pull his feet through on the back somersault and make a back drop landing in a pike position.

Reverse Somersault (See Figure 14)

For all practical purposes, this is a back somersault using a front take-off. The arms swing forward and upward, the hips are lifted forward and a back somersault is executed while the body travels forward away from the take-off position. In the reverse one and one-half somersault, the action is the same as that used with the back one and one-half somersault.

Front Twisting Somersault (Figure 15)

Twisting may be done in either direction. Using the front take-off, the first action with the arms is to reach up as the hips are lifted, pressing the feet up as the body bends at the hips. When the bend is made at the hips, the right hand and the right arm are swung across the chest to the left, the left arm and shoulder is pushed back to the left with the arm bending at the elbow and the hand as close to the left shoulder area as possible. When the right arm comes across in front of the body, the head is forcefully rotated to the left looking over the left shoulder with chin tucked. As the body twists, the bend at the hips lessens to an almost layout position. On completion of the twist, a pronounced pike position is made with the arms extended to a position straight from the shoulders and at a slight angle forward. This bending action serves two purposes, one to stop the twist and, two, to give the diver a pronounced whip action with the legs in a downward motion. This action is necessary to line up the dive for a good entry without getting "stuck."

As the diver develops this twisting action, he will find that a full twist is not the same as two or more twists. The single twist will become a roll to one diver and a snap to another, but he will find that he does not have to go after the twist and wrap up as is experienced in multiple twisting somersaults.

The multiple twisting somersaults should begin basically the way a full twist is done, but the diver will find that the arms are extended for a longer period of time and make a wider and more forceful arc at the start of the twist. They should be allowed to bend as the twist develops and the hands should not be pulled into the body at the

Figure 15.
Front twisting somersault.

Figure 16. Back twisting somersault.

chest but the body should turn into the hands. Experienced divers will find that if they pull their hands into the chest area, it will slow down the twist. Again, to stop the twist, use the same bending into a deep pike as in the single twisting front somersault.

Back Twisting Somersault (Figure 16)

Twisting backwards begins with a back somersault layout. As the hips are lifted, the feet are pressed up. The arm action differs somewhat from the front twisting somersault. Both arms lead the way up, back, and the left arm is bent at the elbow. The head is

forcefully rotated left, dropped back, and the eyes should be looking for the bed over the left shoulder.

As the head turns, the right arm swings up and across the chest. Both shoulders must move in the same direction as the arms, otherwise, the diver will have the sensation of twisting but will only be looking over the left shoulder while doing a back somersault.

On completion of the twist, the diver should bend at the hips to stop the twist. After a period of time, the diver will find that he sees the trampoline during most of the twisting action.

Multiple twisting back somersault should have the same type of wrap-up action as the multiple twisting front somersault. The point of completion again is marked with a pike. If the twist is uneven in number, the pike is usually deeper than the even numbered twist.

For springboard diving, all back twisting dives will be uneven in number. This means that the diver will experience the same pike position and whip action of the legs on completion of the twist as used in the front twisting somersaults.

Multiple Twisting Somersault (See Figure 17)

Figure 17.
Multiple twisting somersault.

Synchronized Swimming

The Physics of Hand Sculling

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Hand sculling in its elementary form is an ancient art, empirically developed and taught. As in all such arts, varied and often inconsistent techniques have been adopted by different instructors. The hand sculling system set forth in *Aquatic Art** was developed on scientific principles, but has never been explained in detail in print. Various inconsistent sculling practices are still widely advocated and taught, though the system developed on scientific principles has been proved sound by over ten years of extensive practical use. The present purpose is to provide a technical exposition of these principles and to apply them to hand sculling techniques. The nomenclature established in the above book will be used.

Basic Scientific Principle of Hand Sculling

This principle is the same as that employed in propellers and fans. In these propulsive devices a blade produces a thrust in line with its shaft by moving in a direction at right angles to the shaft and to the direction of thrust. The thrust in the desired direction is obtained by positioning the blade at an angle to its direction of movement, utilizing the ancient Archimedes principle of the wedge as embodied in the screw. *Similarly, in hand sculling the hand is held at an angle to its direction of travel, producing a thrust at right angles to such direction, along, and in line with the forearm.*

Optimum Hand Angle

In determining scientifically the optimum angle of the hand to the direction of hand travel, the total pressure on the palm at different angles will first be considered.

In Figure 1, a flat blade OA, seen endwise and corresponding to the hand, is moved in the direction LM, with its trailing edge O moving along the line LM and its leading edge A traveling parallel to the latter line. Four hand angles are shown: 0° (OA); 30° (OA^1, angle a^1); 60° (OA^2, angle a^2), and 90° (OA^3, angle a^3).

At 0°, blade OA travels edgewise, and the pressure on it is zero. At 30°, angle a^1, the effective area of the blade OA^1 moving along LM and subjected to water pressure is represented by A^1B^1 normal to LM; that is, the total water pressure on the blade OA^1 corresponds to the pressure that would be produced on a blade

*Aquatic Art, Seller & Gundling, 1957. Out of print.

A^1B^1 moving in the same path. Similarly, the equivalent effective pressure area of the blade OA^2 and 60°, angle a^2, is represented by the perpendicular A^2B^2, and at 90°, angle a^3, by the perpendicular A^3O. But A^1B^1, A^2B^2 and A^3O are the sines of the respective angles a^1, a^2 and a^3. Therefore the total effective pressure on the blade OA traveling at any angle along LM is equivalent to the sine of that angle.

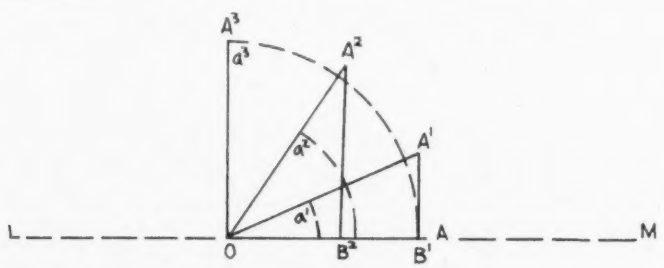

Figure 1

But the desired direction of thrust is at right angles to the direction of movement LM, as already pointed out. Therefore the next step is to determine the proportion of the total pressure on the blade that is exerted in the desired direction at different blade angles. This is determined by resolution of the pressure force, using the standard triangle of forces.

Triangle of Forces

The triangle of forces is used when a force is applied in a given direction must be utilized along a line at an angle to that direction, in order to determine how much of the force is available along that line.

As illustrated in Figure 2, arrow CD represents the applied force, its direction being the direction of the force and its length the amount of the force. The direction in which the force is to be utilized is indicated by line CN. By drawing DE perpendicular to CN, the length of DE will represent the desired available force, the portion of force CD that is available along line CN. An example would be a truck on a street pushing a carrier up a ramp. The portion of the truck's power CD applied along the street that would be available in line with the ramp CN to push the carrier would be determined in this way.

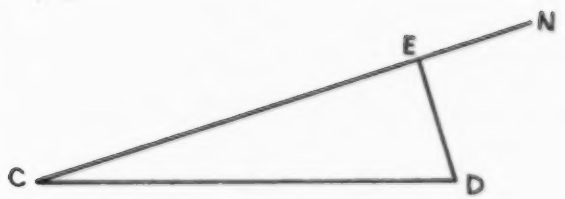

Figure 2

In Figure 3, with the blade at any selected angle to the direction of movement LM, the pressure on OA and its direction are represented by the arrow CD. The arrow is at right angles to OA since the fluid pressure on a surface is measured at right angles to the surface. Completing the triangle of forces, arrow CE is drawn parallel to the desired direction of thrust, indicated by NP, which is at right angles to LM. The triangle is completed by arrow ED at right angles to CE. The arrow CE represents the component of the force CD that is exerted in the desired direction NP.

Since CE is perpendicular to LM, and CD is perpendicular to OA, angle ECD is the same as angle a; and as CE, the resultant force in the desired direction, is the cosine of angle ECD, the component of the pressure on blade OA that is applied in the desired direction is equivalent to the cosine of the angle of the blade to its direction of travel.

Combining these two theorems, since the total pressure on the blade is equivalent to the sine of angle a, and the proportion of such pressure that is exerted in the desired direction is equivalent to the cosine of angle a, the pressure in the desired direction at any blade angle is equivalent to sin a cos a.

As any table of natural functions will show, the maximum value of sin a cos a is obtained when a is 45°.

Therefore the most effective angle of the plam to its direction of travel in hand sculling is 45°.

Practical Considerations

While any palm angle can be selected in the flat scull (wrist straight), the 45° angle should be used. Human wrists are not flexible enough to permit hand revolution around the middle finger to such an angle in the standard scull (wrist bent back) or the reverse scull (wrist bent down); so in these two types of scull the greatest angle attainable without undue strain should be used.

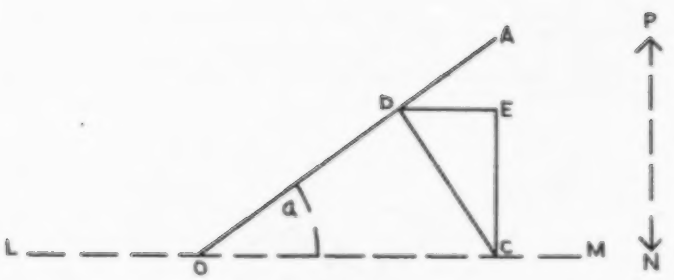

Figure 3

For those having some familiarity with the physics of fluids, specifically hydraulics and the design of propellers, it should be pointed out that other factors, particularly skin friction, turbulence, and cavitation, are not sufficiently great in this particular use where the velocity is so low, to merit consideration.

Inefficient Techniques—Figure 8

This widely used system goes back to the days when sculling was taught by personal imitation and had not been really analyzed. Its long usage makes it difficult to modify. It is not the present purpose to enter into a general discussion of this technique, but simply to point out to its advocates certain objections based on physics which are believed to be clear and unexceptionable.

First, it should be made crystal clear that the production of the most powerful stroke is *not* an object of sculling. It is elementary that the greatest overall power from a stroke is obtained by driving the hand and arm along the line of desired propulsion, which movement must be followed by a recovery movement in the opposite direction. All racing strokes use this principle, which necessarily produces an intermittent drive with each hand.

Short strokes using this principle are called "finning" by the Red Cross, but many prefer "paddling" because of the similarity to the use of a canoe paddle. Likewise, sculling is similar to the use of the sculling oar in rowboat sterns by New England lobstermen.

Sculling was not developed for power, though when performed with skill it can generate surprising power. Its basic object is to produce steady, not intermittent, propulsion, which is desired and often necessary for aquatic maneuvers. Another object is to enhance

the gracefulness of arm movements; paddling is always intermittent and often tends to be jerky.

A physics analysis of the figure 8 movement makes it clear that with this technique, intermittent drive is inevitable. This is clear from Figure 4.

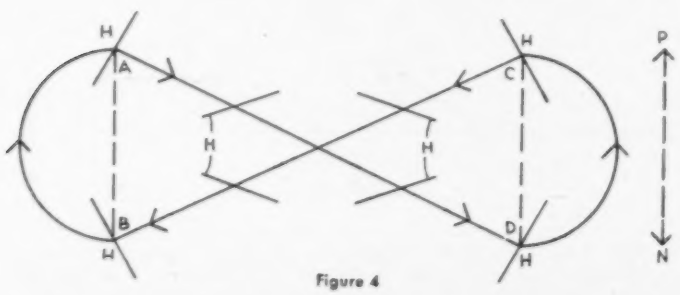

Figure 4

In this figure the hand H, in traveling from A to D, has not only a horizontal component of movement from AB to CD but also a vertical component of travel from the level of A down to the level of D. (These directions refer to the diagram, not to directions of hand movement in use.) Since the vertical component is closer to the direction of propulsion NP than the horizontal path of pure sculling hereafter indicated, it introduces a paddling component of force into the force exerted along this line (CE in Figure 3), which increases the force exerted along this line in pure sculling. The same increase occurs on the return travel of the hand H from C to B.

This increase in power is enhanced by the change in the angle of the hand to the direction of hand movement from A to D and from C to B. In each path the hand is tilted downward as shown in Figure 4. Since the hand angle will in practice be less than the optimum 45° in most sculling, this tilt will bring the angle closer to the optimum and increase the power. This increase will grow as the figure 8 is broadened until the optimum 45° is reached.

But when the hand H traveling to the right reaches D it must go back upwardly the same distance CD which it descended. This upward movement is exactly opposite in direction to the desired direction of propulsion NP. It will not only cause a pause in the drive but must produce a drag. These factors, the pause in the drive and the drag, are both deleterious to the propulsion.

This technique is really a method of adding some paddling power to pure sculling power at the sacrifice of continuity of power. The

extent of the sacrifice is in proportion to the spread of the figure 8, that is, the length of AB and CD. As they are progressively lengthened the method merges into straight paddling, and as they are progressively shortened it approaches pure sculling. The latter term is used to describe sculling in which all of the useful power is produced by the angle of the hand to the line of travel, without any paddling factor, the hand moving back and forth in the same path, reversing the palm angle at each end of the path, as indicated in Figure 5.

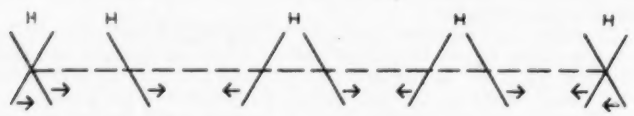

Figure 5

In this technique all of the useful propulsion is obtained from the hand angle, as illustrated in Figure 3 but the propulsion is continuous.

This analysis shows that the figure 8 sculling of Figure 4 is really a mixture of sculling and paddling and can produce more power than the pure sculling of Figure 5, but that the former is intermittent and includes a drag, while the latter is continuous and smooth. Many years of use of pure sculling have proved that this technique can readily produce all of the power needed in use, so the greater power of the figure 8 is not in practice of any value, while the disadvantages of discontinuous drive remain.

Originally the greater power was probably an asset when the skill had not been analyzed and pure sculling was not understood, but this advantage is no longer present, and the adequacy of pure sculling in the fields of principal use–synchronized, art, ornamental swimming, etc.–has long been proven.

It has been noted that really skilled scullers who are in a group supposed to be using the figure 8 very generally flatten out the movement to get smooth, continuous pressure. Also, beginners tend to move the hand like the usual 8, using mostly paddling, the description being misleading.

Conclusion

Therefore, as a matter of physics as well as practical experience, the use of the figure 8 technique produces intermittent propulsion and a drag, while pure sculling is continuous and smooth.

Inefficient Techniques–Cupped Palms

Several other inefficient sculling practices have been advocated by leaders in this field who have not fully analyzed sculling. One of the most common is cupping the hand which cuts down efficiency very markedly when compared to the flat palm. This can readily be demonstrated from the above analysis. Cupped palms may be concave both transversely and longitudinally, which mathematically presents a complex three-dimensional problem, but the facts can be adequately presented by considering separately the two directions of curvature, each presenting a single plane two-dimensional problem, which is much simpler.

Consider the tranverse curvature of the hand (see Figure 6), by the curve from thumb H to little finger J. Only one point K can have a tangent ST at 45° to the direction of travel LM. The angle of every other point on HP to LM will have a lower value of sin a cos a, and therefore the force exerted by the cupped hand in the desired direction NP is substantially less than that obtained from a flat hand in line with tangent ST.

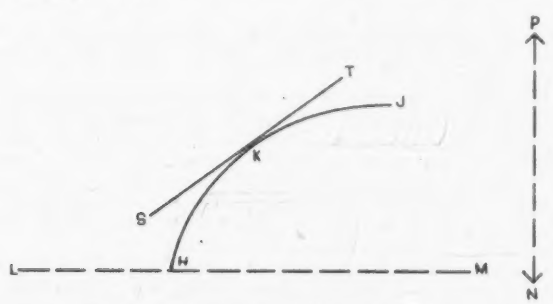

Figure 6. Transverse Hand Curve.

Considering next the longitudinal curvature of the hand along the line of the middle finger as shown in Figure 7 from wrist W to fingertips X, it should be noted that in this figure the hand is moving outwardly from the paper, but the desired direction of thrust NP remains the same. Selecting any point G on curve WX near the thumb end W, the triangle of force GCE shows that theoretically nearly all the pressure on the hand, indicated by CG, is exerted in the desired direction, indicated by CE; but it will be noted that pressure in the right direction falls off rapidly toward the finger-tip end X. In this region the triangle of forces $G^1C^1E^1$ has a much

shorter effective force arrow C^1E^1, showing that the force in the desired direction steadily decreases as the distance from the wrist increases.

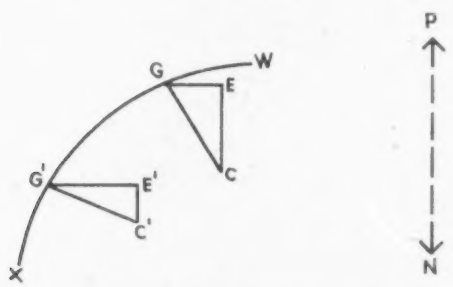

Figure 7. Longitudinal Hand Curve.

This lengthwise curvature also presents some practical difficulties. The thumb portion of the hand adjacent to the wrist is thicker and rounded, offering more resistance to the water; it cannot be fully flattened, and the bad effect is increased as the hand is cupped, as a glance at the cupped palm will show clearly. Therefore, while the latter theoretical analysis suggests greater efficiency as the curve approaches a right angle to the desired direction of thrust at the wrist, the contour of the hand in this region produces turbulence rather than useful pressure. Also, few wrists are flexible enough to bend the hand at right angles to the arm.

Combining these two analyses of hand curvature, it is evident that cupping the palm cuts down materially the efficiency of hand sculling. It is suggested that cupping the palm has probably been advocated because it tends to produce more over-all pressure on the palm by restricting the lateral flow of water, and the greater pressure gives the sensation of doing more work. But, as has been shown, much of the energy is wasted, since it does not produce maximum pressure in the proper direction.

Therefore, in hand sculling an absolutely flat palm must be maintained in order to obtain the maximum thrust in the desired direction.

Inefficient Techniques—Spread Fingers

Certain instructors have publicly favored separating the fingers when sculling, and it has been advocated in print; but this technique is contrary to the teachings of both physics and experience.

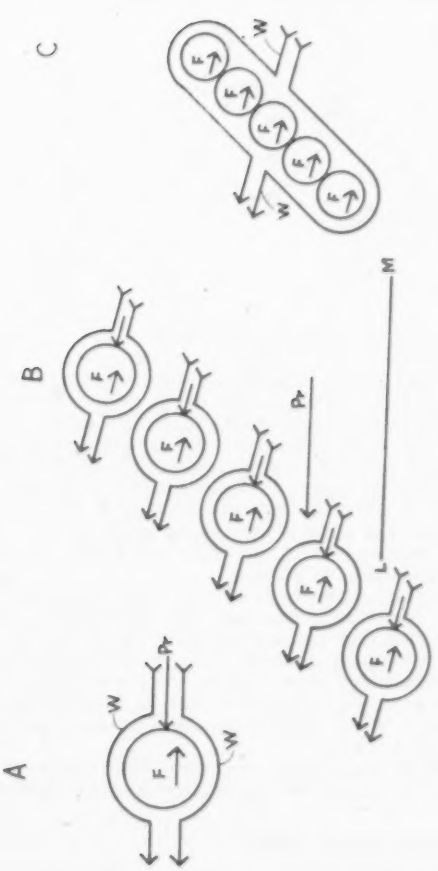

Figure 8

Considering the physics as illustrated in Figure 8, when a cylinder F, such as a finger, is moved through water at right angles to its axis, the water flows around both sides of the cylinder smoothly, exerting exactly balanced pressures on opposite longitudinal faces transversely to flow line arrows W. The only unbalanced pressure Pr on the cylinder F is in line with, and opposite to, the direction LM.

This pressure on F is not affected when the fingers are separated, even when they are at an angle to the direction of movement as in sculling (see Figure 8 [B]), since the water is free to flow between the fingers and the pressure conditions of Figure 8 (A) are maintained. The total pressure on the separated fingers, shown by arrow Pr (B), has no component in the desired direction of sculling drive NP.

However, when the fingers are joined as indicated in Figure 8 (C), the water is forced to flow across the entire surface of the fingers, which act as a blade, and the pressure exerted on them, illustrated by arrow Pr (C), has the desired component in the direction NP.

It should be noted that when the hand is held at a sculling angle with the fingers spread, there is some sculling drive, but it is derived solely from the palm surface.

Consequently when sculling with the fingers spread, the entire effect of the fingers is lost.

As for the teaching of experience, it is only necessary to move the hand through the water in sculling position, first with the fingers spread and then with fingers closed, to note the substantial difference in pressure on the hand in sculling direction.

Conclusion

Technical analysis of hand sculling proves that it is most efficient when the palm surface of the hand is kept perfectly flat, the fingers closed, and the surface kept as close to 45° to its direction of movement as is feasible.

Let's Use More Boys in Swimming Shows

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Most of us at some time have been connected with water shows for the public. The majority of these shows are presented by girls who perform in approximately 15 numbers. Though boys may perform in an occasional comedy routine, this is the extent to which their talents are used. Since this change of pace is welcomed by most spectators, why not use boys more often?

The experience of participating in a water show can be rewarding, challenging, and exciting for both the boys and the audience. There are certain moods that only boys can create. Powerful stroking such as a synchronized butterfly or backstroke can never be duplicated by girls. As a result, the addition of boys gives balance and variety to a swimming show. When boys are properly used, their performances win the admiration of their peers which makes it easier to interest boys in participating in this type of activity. The following are suggestions on how to interest and retain male participation in swimming shows:

1. Use boys from the school swimming team because they are in top physical condition. They have the basic swimming skills on which to build. The scheduling of the swimming show must not conflict with the swimming team's schedule.
2. Never allow a satire of a girls' number. A satire may seem like a good way to ease boys into the show, but then you establish the idea that this is not a serious and admirable activity.
3. Give a limited amount of sculling at first. As important as sculling is, boys will not be content to work on this seemingly minor skill. Later on, when you have their confidence and they are beginning to advance into more difficult stunts, they will understand the importance of sculling.
4. Choose stunts with which boys are familiar or stunts which can be associated with other sports, such as: somersaults as associated with the racing turn, porpoises as associated with surface dives in lifesaving, a kip as associated with a kip in gymnastics. There are other stunts such as back dolphins, handstands, flying porpoises, and racing dives that boys learn easily.

The photographs in this article were taken by Michael Neal, a student at West Irondequoit High School.

5. Use stunts that the boys feel are masculine. At the beginning, stay away from ballet legs and other stunts that boys associate with being "sissyfied."
6. Introduce synchronized stroking as a team effort. This is learned easily by them since team effort is second nature to most boys.
7. The selection of music is most important; choose that which is strong and masculine. Selection of music might include some of the following: *West Side Story, Lawrence of Arabia, Ben Hur, Matador,* or *Victory at Sea.* Any recording with a strong rhythmic background can be used. Soft, dreamy music can be used for boy-girl numbers later on.
8. Eliminate deck work for boys at the beginning. They will feel uncomfortable out of water. Let them gain their confidence in familiar territory first.

Once you have established male participation as an integral part of your swim show, the opportunities are unlimited. Boys will begin learning the more difficult stunts involved in boy-girl routines and will now develop the finesse of sculling which was neglected at the beginning. This is where they discover that the activity is a demanding one involving many skills and a great deal of conditioning. This is also the time to start working on dual stunts and lifts. Lifts are the high point of the boy-girl numbers and are particularly appealing to the audience. The boys have a feeling of great strength as they lift the girls out of the water. Photographs 1-8 illustrate some of the lifts that have been used over the years at Irondequoit High School. They are not particularly difficult; the only requirements are practice and balance. The principles for the execution of all lifts are the same whether the lift be from the water or off the deck of the pool. Strength is not a major factor. The important points are that–

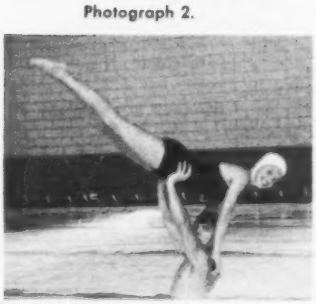
1. The girls must maintain a firm position.
2. The boy must be able to lift with his legs, not his back.
3. The boy's arms must be firm and elbows locked at the start of the lift and throughout.
4. The girl's center of gravity in the lift position must be located during the practice sessions.
5. The boys hand placement for the lift is determined by the girl's center of gravity which differs for each girl. With practice, balance becomes the key to successful lifts.

The learning of lifting techniques begins with the elementary back lift done in chest-high water. The girl takes a back float position, and the boy submerges into a squatting position below the floating girl, places his hands at the balance point somewhere on the lower back area, extends arms with elbows locked, and, with back straight, stands up lifting the girl above his head. To end the lift, the boy returns to squatting position with elbows locked and the girl in

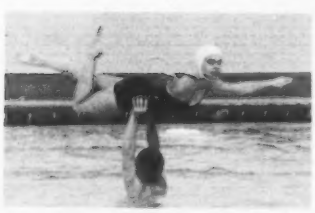
Photograph 1.

Photograph 2.

Photograph 3.



Photograph 4.



Photograph 5.

Photograph 6.

LIFT VARIATIONS

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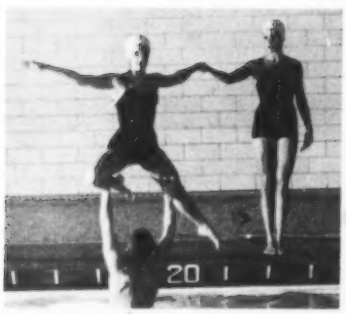


Photograph 7.

Photograph 8.

Photograph 9.
Starting position
for front layout
lift from water.

(continued on next page)

floating position. Another simple lift is the front layout lift from the water. See photograph 9. The more difficult deck lifts should not be attempted until the elementary water lifts are mastered.

Working with boys in a swim show is a wonderful experience. The boys and girls complement each other and together develop a pride in doing something well. The general philosophy of most water shows is to have the strongest numbers at the end so that they leave a lasting impression on the audience. Our experiences over the years have shown us that the numbers using boys fall into this category. So let's use more boys more often.

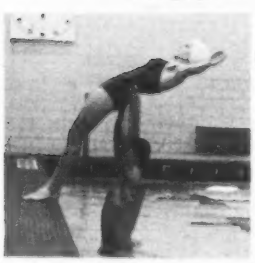
Photograph 10.

Photograph 11.

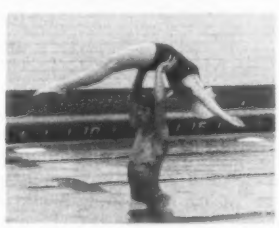
PROGRESSION FOR FRONT LAYOUT LIFT FROM DECK (Photographs 10-12)

Photograph 12.

Photograph 13.



Photograph 14.



Photograph 15

PROGRESSION FOR BACK LAYOUT LIFT FROM DECK (Photographs 13-15)

Conditioning for Synchronized Swimming

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Northridge, California

Before developing a conditioning program for synchronized swimming, a complete understanding of the competitive sport is essential. Competitive synchronized swimming can be compared with international competition in figure skating, for the two sports are planned and judged similarly. In synchronized swimming stunt competition the performer executes three required and three optional stunts. This is similar to the school figures used in figure skating. In both sports, the degree of difficulty for each stunt is calculated with the judges' scores to arrive at the total execution grade. A routine event in which the performer(s) swims or skates in synchronization with music follows the stunt competition. As in figure skating, five stunts must be incorporated within the routine. Again, the degree of difficulty is calculated with the judges' scores in awarding a total score for routine execution. An additional score is given for the routine in each sport for the style of the performance.

A conditioning program for the synchronized swimmer must include development of muscular strength, endurance, flexibility, and cardio-respiratory endurance. Total body development is essential for participation in this sport. The primary emphases are–

1. *Forearm strength in rotation* for sculling, the total means of support in the execution of stunts.
2. *Leg strength in all actions.* Powerful kicks are essential for fluidity in the performance of a routine.
3. *Leg, shoulder girdle, and back flexibility* to promote ease in the execution of stunts and transitions.
4. *Cardio-respiratory endurance* to execute an average routine consisting of four six minutes of strenuous exercise.

Off Season

During the off season the serious synchronized swimmer should be developing strength and increasing flexibility rather than working in the water. However, a light workout for maintainance of endurance is recommended. Competitive swimming coaches James Counsilman and George Haines recommend the use of isotonic exercises for their swimmers. Isometric exercises may be similarly incorporated for the synchronized swimmer. Intermediary contractions should be included because when a muscle is contracted

isometrically in only one position, the muscle tends to develop maximum strength at this angle only. Since a synchronized swimmer must be proficient in all styles of swimming, specific work for strength development in each pull and kick pattern is essential. Adjustable wall pulleys may be used for strength development in each of the basic stroke patterns as follows:

Crawl, Butterfly, Breastroke. The *crawl, butterfly* and *breaststroke* pulls should be done from a stable standing position with the body bent at the waist. The arms pull through the full range of the power phase of each stroke. The number of repetitions and the weight pulled must be determined for each swimmer according to his strength and present physical condition (See Figure 1).

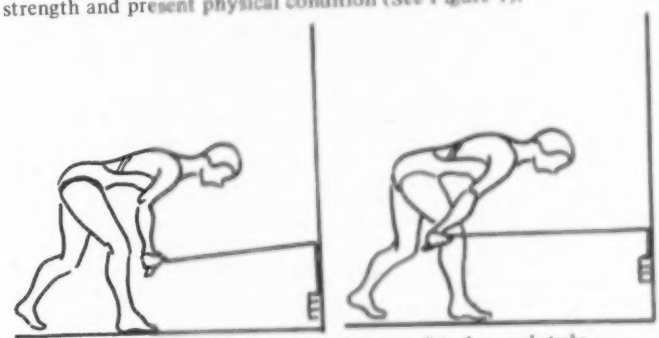

Figure 1. Developing strength for the arm pull in the crawl stroke.

Back Crawl, Inverted Breaststroke, Front Crawl. The *back crawl* and *inverted breaststroke* pulls should be done from a supine lying position on a bench. It may be necessary to secure the feet to avoid slipping during the pull phase. Again, the arms should be pulled through the full range of the arm action, using the bent arm position for maximum power (see Figure 2).

Increasing leg strength for the *back crawl* and *front crawl* kicks isotonically is effective only if proper technique and full extension is demanded through each cycle. The primary emphasis of each kick is up, therefore, the swimmer should stand facing the pulleys for the crawl kick work cycle and have his back to the wall for the back crawl kick work cycle. Working one leg at a time for the crawl kick, the swimmer must attach the pulley to the ball of his foot and pull it back first from the hip and then from the knee, employing his hip extensors and then his knee flexors and his ankle extensors. The

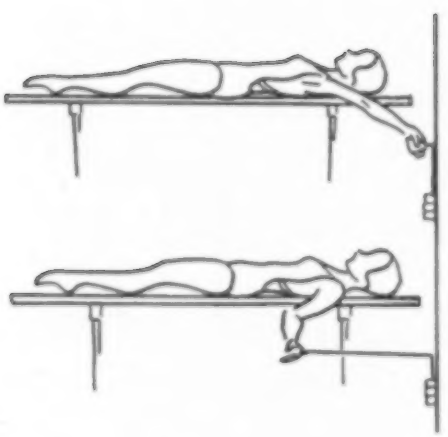

Figure 2. Developing strength for the arm pull in the back crawl stroke.

swimmer may use the wall for balance and support. In the back crawl kick work cycle, working one leg at a time, the swimmer should attach the pulley to the top of his foot and pull it forward first from the hip and then from the knee, employing his hip flexors and then his knee extensors and his ankle flexors. When working on flutter kick leg strength, both legs should be worked equally through the full range of action (approximately an 18 inch span). The pulleys should be attached so that the toes may point in slightly. The swimmer should be stabilized by bracing himself either on the wall, a chair, or a table (see Figure 3).

The most effective kick for either the *breaststroke* or *inverted breaststroke* is the whip kick. Isotonic strength development for this kick is performed in a semi-supine lying position on a bench. Leaning back on the elbows, attach the pulleys to the balls of the feet and press the legs through the full range of the whip kick by first utilizing the hip and knee extensors and finishing with the ankle extensors, with some adduction and rotation taking place. Again, the swimmer must stabilize himself by holding on to the bench. Too much hip or knee flexion should be avoided and final ankle extension should be stressed (see Figure 4).

Since sculling is primarily an action of wrist rotation from pronation to supination, a good method of developing strength for

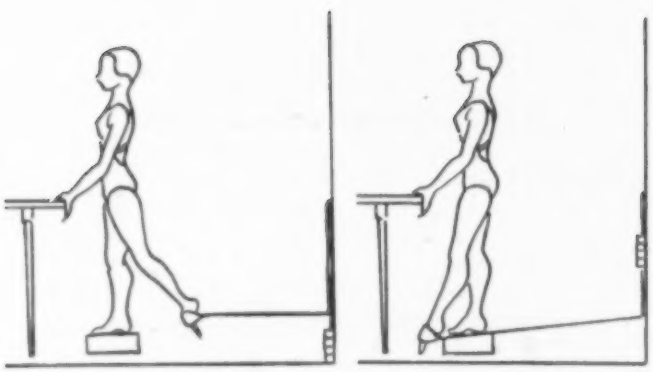

Figure 3. Developing leg strength for the back crawl kick.

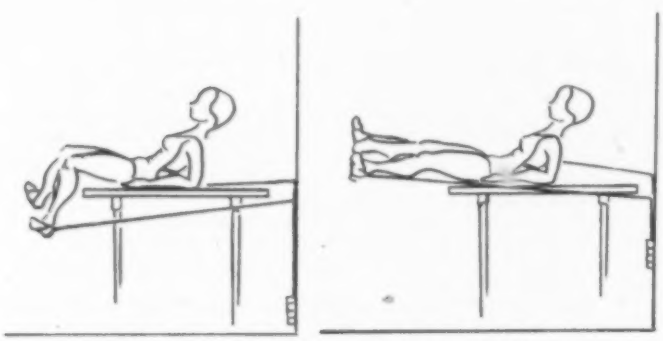

Figure 4. Developing leg strength for the whip kick.

this action is lateral wrist curling. Attach a weight to a string tied to a spool. The swimmer should roll the string on the spool by using a wrist rotating action while holding arms at full extension. Greater emphasis should be placed upon inward or supination rather than pronation rotation, for this is the cause of most sculling difficulties (see Figure 5).

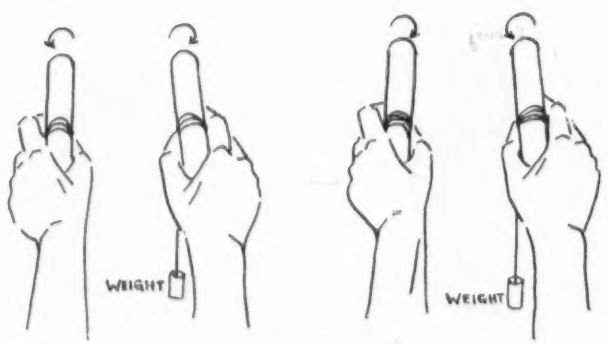

Figure 5. Strength development for sculling.

Working toward increased flexibility for synchronized swimming is nothing more than a program is calisthenics, with emphasis on stretching. Specifically, the synchronized swimmer is concerned with developing hyperextension in the knees and ankles and full extension in the toes. Normal range of motion is required in other areas of the body. The synchronized swimming coach can accomplish all that is needed through a postural development program, a round shoulder correction exercise, and a hamstring and ankle extension stretch. Frequently, adequate flexibility is inherent, but when a problem occurs, stretching exercises are necessary (see Figure 6).

Pre-Season. During the pre-season the serious synchronized swimmer must develop both endurance and skills. This can be done in the pool. Little time should be spent on weight training at this stage, except for reinforcement of the proper mechanics of execution. Stunts should be practiced at the same rate of speed as they are meant to be performed in competition. Swimmers tend to execute stunts at the same rate of speed in competition as they have done in practice. Sculling and stroking, on the other hand, should be practiced at several rates of speed because tempo and rhythm changes in music may demand modification in their speed of execution. The synchronized swimmer must adapt his stroking and sculling to the music during a performance. Since the author believes that it is the *quality* rather than the *quantity* of the workout that is important, a good two hour workout three to four times a week is sufficient for the pre-season.

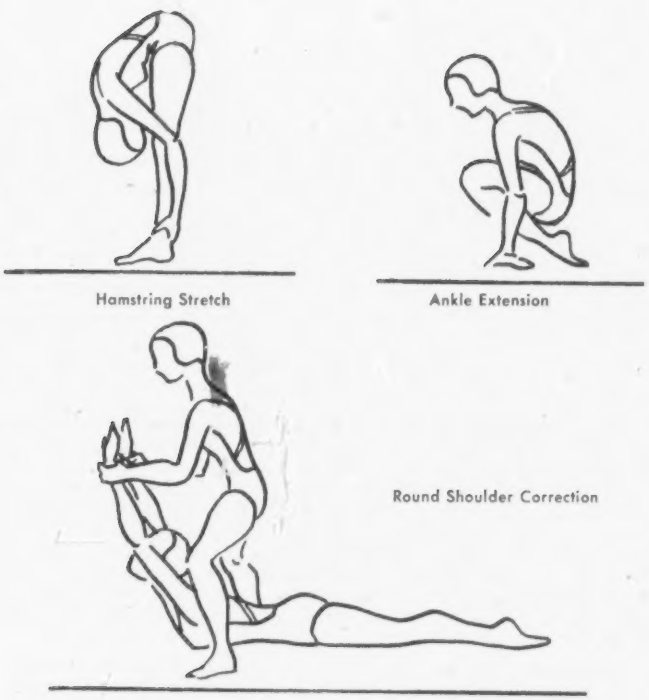

Figure 6. Stretching exercises for increased flexibility.

An example of a pre-season workout would be one hour of stroking and sculling practice as follows:

Warm-up 400 yds. kicking (100 yds. each kick). *(10 min.)*
50 yds. sculling headfirst.
50 yds. stroking with partner.
50 yds. sculling footfirst.
50 yds. stroking with partner.
50 yds. sculling canoe.
50 yds. stroking with partner.
50 yds. sculling overhead.
50 yds. stroking with partner. *(40 min.)*
100 to 400 yds. working on errors. *(10 min.)*

Follow with one hour of stunt practice with correction.

At *no* time during the two hours should the swimmer be permitted to rest or stop at the side of the pool. In addition, encourage working with different partners during the stroke practice, and encourage challenge at sculling for speed. Both of these techniques seem to develop adaptivity to various tempos in routines. Three to five additional hours weekly must be spent working with a team routine for synchronization.

Season. During the competitive season the coach should concern himself only with problem correction. Any drastic change in the performance of a stunt or a pattern in a routine may cause chaos, particularly in a team routine where four to twelve swimmers must adjust. During the season practices should be confined to working toward perfection in the competitive routine performance. In doing this the swimmer should review all of the potential required stunts regularly, perfect his optional stunts, and practice the required stunts and the transitions to and from those stunts until he can "do it in his sleep."

Create Your Own Swimming Compositions

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Creating a swimming composition is rather like going into a jungle. There are no roads or signs to lead you in the direction you may wish to go. It is no wonder, then, that creating a swimming routine often has a paralyzing effect on persons who wish to engage in synchronized swimming and who are glad to shift the responsibility of composition to someone else.

While choreography in any form is not easy, and although it does take considerable effort and thought, you will find that the effort and time spent on composition has its rewards and satisfactions. There is a sense of pride and accomplishment in performing something which you yourself have created or had a part in creating. You will also surprise yourself by discovering that you do have some originality and creative ability even though you may not think so at first. By creating your own routines you can tailor them to suit you–your ability, your personality, your preferences. Therefore, it is most desirable that persons who wish to do synchronized swimming should also take part in that important phase of the activity–creating swimming compositions.

Probably the best advice to offer potential swimming choreographers is, "Don't bite off more than you can chew!" For a beginner to attempt to invent swimming choreography for Rachmaninoff's *"Prelude in C# Minor"* is about as sensible for a nonswimmer to attempt to do the crawl across Lake Michigan.

Instead of plunging headlong into advanced choreographic problems, you might start out by combining synchronized swimming skills without music, but keeping a definite rhythm in mind (such as 4/4 time or 3/4 time). For instance, you may combine a stroke with another stroke (2 breast strokes–6 counts; followed by 2 side strokes–6 counts); combine a stroke with a stunt (2 breast strokes–6 counts; followed by a forward pike somersault–6 counts); combine a stunt with another stunt (single ballet leg right–4 counts; single ballet leg left–4 counts; followed by dolphin–8 counts). As you gain confidence go on to longer sequences.

The next step could be to devise simple sequences of swimming skills to fit a short familiar tune–such as *"Row, Row, Row Your Boat"* or *"London Bridge Is Falling Down"*–humming the music to yourself.

Unless you are planning a solo routine, it is well to work with others who will be taking part in the routine. Partners in duets

should work together, and members in a group routine should compare and exchange ideas for their swimming composition. Seek the guidance of your swimming instructor or supervisor.

During this preparatory period, you will find it advantageous to learn all you can about two closely related subjects—music and dance. The more exposure you have had to music (whether in glee club, band, orchestra) the easier it will be for you to understand music and have some idea of its structure.

Dance training is helpful, not only because dance and swimming choreography have many points in common, but also because many dance movements can be adapted for use in swimming routines or will provide you with ideas. Schools and colleges usually offer a variety of courses in both music and dance which you will find useful in synchronized swimming.

While there is no set formula for creating a swimming composition, there is an answer to the question, "What do I do first?" You must either have an idea for a swimming composition and then find music which suggests this idea, or you must select a piece of music which appeals to you and let it suggest the theme or idea.

Selection of suitable music is often a trying task, for music just is not composed especially for swimming. However, by skill and cleverness, swimming routines may be devised for practically all types of music. At the beginning do not handicap yourself by choosing a long, complicated selection. Instead, choose a short record—two minutes or so in length—with a definite beat and steady tempo (most marches and waltzes fall into this category). If possible, find a record with a tune which is already familiar to you or is catchy and easy to learn. This will simplify the work ahead.

Then should follow intensive sessions of listening to the record over and over again, until you can remember it from beginning to end. It is here that some knowledge of music fundamentals will be useful, for you will be able to recognize the rhythm and follow the division of the composition into phrases and themes. It is helpful, even with fairly short and simple compositions, to devise some system of outlining the music—jotting down a mark for each measure and grouping the measures into phrases and themes. In this outline, such things as accents, changes in tempo and in volume can be noted. All these are important when composing a routine in order to interpret the music.

Some composition writers advocate getting into a pool and swimming around while the record is being played, and in this way trying out various skills to find those most suitable. This is a good plan, provided your pool is available for such sessions. But too many of us do not have such ideal conditions in which to work and must figure out a good portion of our routines on land (or on paper)

before getting into the pool, and then make adjustments and changes. Even if you do have unlimited use of pool facilities, much time and energy will be saved if you thoroughly familiarize yourself with the music first.

A swimming composition should be synchronized with the music and should interpret the music. Everyone has a fairly good idea of what synchronizing with the music means, but interpreting the music is often another stumbling block for choreographers. If you listen to the music carefully, you will find that it brings to mind certain thoughts or ideas. Often the title of a selection can be used as the title of the routine and as the theme. But if the title is not suitable or too descriptive, then you must use your own imagination.

Remember, there is not just one set way of interpreting a particular piece of music. There may be many ways, although it is true that some interpretations are better than others. A theme or idea does not necessarily mean telling a story. It may express a mood or feeling; it may suggest or imitate something or someone.

Whether your routine starts on land or in the water depends upon you (your ability to do something on land, or your desires), the music and the theme. The purpose of land entrances is to set the mood for the work to follow in the water, but if your theme concerns fish, then it would be more appropriate to start in the water.

Try to carry out the theme throughout the routine. In representing puppets or wooden toys, adapt the stunts and strokes used so that they are stiff and precise in movement such as would be made by such objects. In *"Waltz of the Flowers,"* the figures should be performed in a smooth, flowing, and graceful manner.

Variety is another important point—but variety does not necessarily mean using as many different strokes and stunts as possible. Variety may be achieved by using only a few stunts and strokes, but by making slight variations in their form when repeated, or changing the direction or pattern in which they are performed. It is better for the beginning choreographer to keep her first routines as simple as possible.

Exploring Creative Composition

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Many teachers of synchronized swimming are interested in developing creative expression in their students, but they may feel inadequately prepared to do this. The following article is an attempt to give teachers some guidelines for exploration of aquatic movement toward more interesting composition.

In the problem-solving approach to teaching composition, the teacher explains and demonstrates the particular topic under discussion and then sets related problems for the students to solve. They compose short studies based on the topic, and the teacher makes suggestions as to how the studies might be made more expressive. It is in this give and take between student and instructor that actual learning takes place.

In her book, *The Art of Making Dances* (Holt, Rinehart and Winston), Doris Humphrey says, "Every movement made by a human being or an animal has a design in space, a relationship to other objects in time and space, energy flow (dynamics), and a rhythm."

DYNAMICS

Many people think of movement in the water simply as "swimming," a rather vague, relaxed type of movement projecting relaxation rather than tension. In life, however, movements are of many different tensions or qualities, and it is the contrast of tensions that makes movement exciting and expressive; movement at one tension level becomes dull. Aquatic movement offers may different qualities for exploration.

Sustained quality movements are characterized by an even and steady release of energy throughout the movement phase. This is controlled movement, which is used a great deal in synchronized routines since control denotes skill. When used in contrast with other movement qualities or enlivened by a breath feeling, sustained movement can be exciting. Impulse or breath feeling is a slight lift occurring at the beginning of a movement which imparts life to the movement and gives it a slight feeling of rise and fall.

Abrupt quality movements are short, sharp bursts of energy. They are most easily seen and used above the surface of the water in motions of the body extremities (head, arms, legs).

Collapsing quality movements suggest the body's giving in to gravity whether simply by a dropping of an arm or by a total collapse in the center of the body.

Vibratory quality movements are extremely quick, short, abrupt movements executed with difficulty in the water. In the air, however, vibratory movements can be very effective (e.g., swan-like or bird-like thematic movements).

Swinging quality movements are rhythmic to and fro actions usually executed on the surface of the water. For example, giving a marlin turn a swinging quality might be more consistent with the overall quality of the theme of a particular study.

Ballistic quality movements are thrusting or throwing movements of the body or a body part. Ballistic movements are more forceful than swinging quality movements. Some are characterized by a momentary suspension or equalization of muscle tensions before gravity forces the body to descend. An example of ballistic movement with suspension is a thrusting barracuda where the body rises quickly to hip level out of the water in an inverted position and pauses momentarily before it descends.

Teaching Dynamics

One lesson might be devoted to the thorough exploration of two contrasting qualities.

1. The particular quality is demonstrated by the instructor on land and then discussed and attempted by the students. At first the quality is explored in isolated body parts, and then it is continued into total body movement. As they work with the quality, the students try to feel the amount of tension necessary to project the desired quality. For example, sustained quality requires steady, controlled tension in order to project to an audience.
2. The quality is explored in the water in isolated body parts using a kick or scull to propel the body.
3. The quality is explored in the water in total body movement. For example, when attempting collapsing movements in isolated body parts, the swimmer might be kicking on her back around the pool, experimenting with motions of head, shoulders, arms, hands, elbows. Then she begins working from the center of the body, giving in to gravity and allowing the collapsing movement to lead her into other movements. The very action of giving in to gravity will impel her body to continue to move in one way or another. She should follow this tendency and thus arrive at a short phrase of movement.
4. A movement sequence is then composed based upon two contrasting movement qualities which have already been thoroughly explored in class.

Examples are: abrupt vs. sustained, sustained vs. collapsing, vibratory vs. swinging. The movement sequence is presented to the class for criticism and suggestions. As the students watch they may discover some emotional quality or expressive meaning communicated by the movement qualities in the sequence and point this out. Thus the choreographer begins to realize that certain qualities express moods and feelings and to store this knowledge away for use in developing compositional material.

TEMPORAL FACTORS

The potential aquatic choreographer should be acquainted with the rhythmic structure of movement on land and in the water. She should understand the basic meters, underlying beat, rhythmic pattern, phrasing, accent, and tempo. All these can be discussed and demonstrated in theory and then practiced in class assignments in the water.

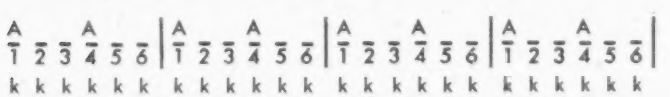
In real life, walking carries the underlying beat for movement on land. In aquatics kicking or sculling provides the underlying beat and should be a part of the total rhythmic structure of any composition. In swimming, the legs are expressive in much the same way as the arms are in stroking.

Teaching Rhythmic Organization

1. Begin with individual stroking. Each swimmer listens to the even, underlying beat set up by various body parts moving in the water.

   Example: Front Crawl

   Flutter kick supplies underlying beat. The arm stroke provides the rhythmic pattern and accent as the beats are grouped together to form 6/8 meter. The tempo is fast or slow according to the speed at which the student chooses to swim.



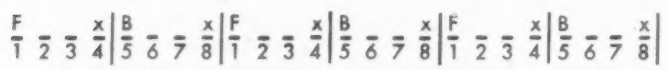
A = arm lift supplying accent

k = kick supplying underlying beat

Begin with no accompaniment. The swimmer should hear the even beat and feel when the arm is lifted out of the water as well as when the arm enters the water. She should also feel the even pulse of the underlying kick.

2. The swimmer matches her beat to that of a partner so the sounds of the two arms entering and leaving the water are synchronized.
3. Choose as accompaniment a piece of music of 4/4 meter or use a drum to supply sound. The two partners now match their swimming to these beats. They must not wait to hear the first beat of each measure but must anticipate the beat in order to arrive exactly with each other and the music.
4. In partners, swim a pattern of four front crawl and four back crawl beginning with the right arm and turning onto the left side on the fourth stroke. In this pattern there is an accent on the first beat of each measure with another still stronger accent occurring each time the body changes facing. A phrase of movement consists of the four front crawl and four back crawl strokes.

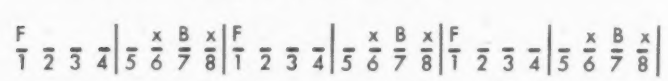
Pattern #1 (turning on every fourth stroke)



x = turn

5. In partners, swim a pattern of front crawl and back crawl turning from front to back on count 6 and from back to front on count 8. Now the accent is arbitrarily being imposed on counts 6 and 8. There are now two stroke patterns utilizing changes in stroking on different counts of the phrase.

Pattern #2 (turning on strokes 6 and 8)



x = turn

6. After the swimmers are familiar with both patterns, the instructor can compose two series of the patterns, teaching series #1 to one partner and series #2 to the other partner. For example: Swimmer #1 . . . 4&4, 6&8, 6&8, 4&4; Swimmer #2 . . . 4&4, 4&4, 6&8, 4&4. Now the swimmers are performing two different patterns sometimes in unison, sometimes in opposition. Simple changes of stroking or facing provide rhythmic interest. Let some students watch while others perform so they may understand how the patterns look. This is only a simple pattern; many others can be developed along similar lines.

Students should know the basic meters: 2/4, 3/4, 4/4, and 6/8 and the qualities of movement each suggests. For example, a brisk 4/4 piece might suggest abrupt quality martial-like motion, whereas 6/8 often implies a swing-like quality. Swimmers should also become familiar with other meters such as 5/4, 7/4, 9/8, and 12/8 as well as syncopation where the accent is placed on beats not normally accented.

SPATIAL FACTORS

The body in the water forms a design of bony segments even as it traces a path (design) through the air and water. The body's facing and focus change, as do its directional possibilities, its symmetrical and asymetrical designs, and its relationships to other moving bodies. The choreographer should have a thorough understanding of these spatial factors. The body's facing and focus are intimately linked with its directional changes; however, it is important to be able to distinguish among all three.

Facing

The front of the body faces a particular wall when standing, or a particular part of the pool when lying in the water. As it turns, it faces different walls. These facing changes can occur even as the body continues to move in one direction. For example, if the theme of a composition suggested a force pulling in one direction, the body might only move to and away from this force in one or two directions, but the movement could be made interesting through use of changes of facing and focus.

Teaching Facing Changes

1. On land, explain and demonstrate body facing and possible facing changes.
2. In the water, experiment with rolls in layout, tuck, and pike positions, both on the surface and underwater. These movements are simple facing changes.
3. Experiment with other movements above and below water that are basically facing changes such as somersaults in tuck, pike, and layout positions, marlin turns, swordfish, ballet leg rolls, etc.
4. Compose a movement sequence emphasizing facing changes. The instructor aids students in selection of suitable movements.

Focus

Focus indicates where the performer's eyes are looking and by the intensity or lack of intensity can give the swimmer's expressive

movement power or lack of power. The water, with its tendency to obscure, links focus with body facing more than it ordinarily might in order to make focus more effective.

Teaching Focus

1. Experiment on land with focus in one direction while moving in the same direction, then try moving in one direction while focusing in the opposite direction.
2. In the water, working on the diagonal, compose a sequence of movement emphasizing focus on a certain point. At some point in the pattern, shift the focus away from the focal point to give a feeling of conflict, then shift back again.
3. Compose a movement sequence emphasizing focus and facing changes.

Direction

Directions are the paths that the body traces along the surface of the water and through the water and air. Directions are either straight or curvilinear; combining straight-line directions results in rectangles, zig-zags, triangles, and other linear designs. Interesting pool patterns can be developed simply by using forward, back, and side directions. As soon as diagonals and level changes are added, the problems become more complex.

Teaching Directional Changes

1. On land, discuss the possible directions in which the body can move (forward, backward, up, down, and sideward) and possible linear and circular combinations.
2. In the water, compose a stroke pattern utilizing three directional changes. Make the pattern linear or curvilinear in design.
3. With a partner, take one of the two patterns and learn it together. Then change the pattern so that at some point the partners are moving in different directions and at some point in the same direction.
4. Compose the same type of pattern as in #2 for three people.
5. Demonstrate patterns and discuss how the directional changes could be made more effective.

Teaching Level Changes

1. Warm up by sculling in layout position head first and feet first on the back, side, and front.
2. Scull in the above positions head first, changing level diagonally and directly up and down.

3. In hyperextended (arched) position, scull or scoop the body head first or feet first as in a back dolphin or a foot-first dolphin. This shows that when the body is changed from a layout to an arched or curved position, the body moves in a curvilinear direction.
4. In side-arched position, scull the body in circles, first on the surface (as in a shark) and then changing level, moving both head first and feet first, still making a curvilinear path (ascending and descending in curves).
5. Problem: Compose a pattern of changing level curves utilizing different body positions (e.g., side, front, back). The student is now working with changes of level and is also composing a study whose theme is curvilinear designs in motion.

Design

Design is all around us. Buildings, new and old, trees, mountains, paintings, people—all have shapes or designs. In synchronized swimming, there is a tendency to use symmetrical rather than asymmetrical designs. Everything is even. If an arm lifts on one side, it is bound to lift on the other side. There is, however, room for both types of designs in synchronized composition. Symmetrical designs give a feeling of stability; assymetrical designs give a feeling of excitement and unpredictability. Straight-line patterns suggest strength while curvilinear patterns suggest flow. Straight-line patterns in opposition give a feeling of conflict to the viewer.

Teaching Design

1. The instructor explains and illustrates symmetrical and asymmetrical, straight-line and curvilinear designs. Pictures and drawings can be used to illustrate these designs.
2. On land, experiment with straight-line and curvilinear design movement.
3. In the water, compose a movement pattern of straight-line or curvilinear asymmetrical designs. Present the sequence to the class for criticism, Ask what emotions or ideas the patterns suggest to the rest of the class.
4. Compose and demonstrate studies in symmetrical straight-line or curvilinear designs with a partner. Discuss and evaluate.
5. Find a piece of music that suggests a design to you and compose a pattern for the first 16 measures. Note the need to adhere to the design of movement chosen throughout, thus carrying out the thematic design.

Group Relationships

Duet

A duet should be more than just two people swimming a solo together. The twoness of a duet must be inherent in its choreography and structure. The swimmers should choose complementary and related movements as well as strictly unison movements. This makes the presence of two people a necessity. Unison movement can then bring climax and excitement to the composition by the rarity of its appearance.

Suggested Duet Studies

1. Compose a short study of 32 measures. At one point in the study the two swimmers should be touching each other, and at another point they should be at two different levels in the water.
2. Follow the leader with the two swimmers changing role as leader. One person should take the dominating role, the other the passive one. Look for emotional connotations. Do not allow trite stunts to be used.

Solo

A solo swimmer has to have an interesting composition. She can do many more complex movements than any group since the eye of the spectator is focused only on her. The choreographer must be careful, however, to choreograph for total design both underwater and above the water.

Trio, Quartet

Again it is important for each swimmer to be necessary to the composition. The choreographer should explore all possible group relationships.

Trio: 3, 2-1, 1-1-1.
Quartet: 4, 3-1, 2-2, 2-1-1.

Large Groups

The number relationships should be explored thoroughly in any large group; however, breaking a large group into too many small groups at various places in the pool can prove distracting. If there are several small groups, one group can be dominant while others lie still or stay at the side of the pool.

Unison, Sequential, and Contrary Motion

Movement of a group in unison can be extremely interesting when it is contrasted with other types of motion such as sequential, parallel, and contrary motion.

In sequential motion, one or two people move, followed by the movement of another person, so that all are not moving at the same time.

In parallel motion, two or more people are executing the same motion but at different levels.

In contrary motion, two or more people are moving in opposition to the other.

Teaching Different Types of Motion

1. Explain the difference between sequential, parallel, and contrary motion.
2. On land, experiment with the three types of motion in threes using simple movement patterns.
3. In the water, working in threes, compose a simple movement pattern of 16 measures utilizing sequential and contrary motion as well as unison motion. Be certain the movements chosen are simple since there is no need for complicated movement with the variety of motions and group relationships. Note how exciting unison motion is when it does come, bringing a feeling of climax to the movement phrase.

The student has now explored the dynamics of aquatic motion, its temporal factors including its rhythmic structure, and its many spatial factors such as changes in facing, focus, and direction, design possibilities, group relationships, and different types of motion. What has this exploration accomplished? Hopefully, it has given the aquatic composer some idea of how she may manipulate her aquatic movement material. It has taught her that she must remain true to her basic underlying idea be it a movement quality or movement design. It has given her some criteria for evaluating the movements she selects for her composition and some understanding of how to vary her movement material while working within the limitation of her theme.

This approach to teaching may seem difficult to one who has never tried it, but once begun, the students themselves supply the instructor with ideas for continuing. It is most rewarding to see students working creatively with direction from the teacher, and as their compositions improve, the teacher will see that there is much to be gained from this approach.

Speed Swimming

Training Program for Girls Competitive Swimming

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The fact that each club or school program is unique in facilities, pool time, number of swimmers, and background of the participants should not be a factor in starting a swimming team. We are well aware that girls need competition as much as boys, and what is better for fulfilling this need than being a member of a competitive swimming team?

The method of training competitive swimmers has changed over the past years, as evidenced by the phenomenal times now being written in the record books. These new records are possible because coaches are learning more about training methods and stroke mechanics through research and are willing to experiment.

You, as a coach, have two prime objectives to meet in your training program. The first is to prepare your swimmers physically so that they have the strength and endurance to complete their required task, and the second is to analyze your swimmers' stroke mechanics in order to correct mistakes that would decrease their efficiency. These two objectives are not met independently, and they should be stressed throughout each season.

DRY LAND EXERCISES

Dry land exercises and interval training seem to be the key to meeting the first objective. The fact that swimming per se does not develop strength means that some other method for developing strength must be incorporated into the program. There has always been controversy among swimming coaches as to the advisability of dry land exercises. All leading swim coaches agree that most exercises are good for physical fitness, but they differ in the degree to which they use dry land exercises. Each coach must, therefore, decide for herself whether she feels dry land exercises are necessary for her team, and this decision can only be reached by experimentation. No one program of dry land exercises can be the answer for every individual. Exercises should be given to each swimmer according to her needs. For example, one must recognize that body builds differ and that each stroke demands different degrees of strength, flexibility, and endurance.

The three S's of swimming exercises have been referred to as strength, stamina, and suppleness. Strength can be obtained through resistance exercises. Stamina is endurance and can be built up through certain calisthenics, running, use of a rowing machine, and lots of hard swimming. Suppleness is flexibility and can be developed through stretching exercises. A swimmer must have strength, flexibility, and endurance in order to reach her optimum speed.

The strengthening of one set of muscles tends to reduce the degree of flexibility around the particular joint involved; therefore, it is unwise to increase strength to too great a degree. It is just as unwise, however, to increase the range of movement over which a joint can work without some exercise for strength.

Most women's team s seem to have limited time in the pool, so it might be wise to set up some time outside of practice time in the pool when the girls can do exercises. Three times each week should fill the needs of most swimmers; if possible, more time might be spent on exercises before the season begins.

There are certain muscle groups which, when strengthened, will help all swimmers. The muscles which hyperextend the shoulder pull the arm through the water and provide the main source of propulsion. The inward rotators of the arm are used when the strokes are done properly. Many swimmers lack the strength in the wrist and finger flexors to handle all the resistance their hands encounter in the water. As a swimmer finishes her push in the butterfly, crawl, and backstroke, she uses the powerful extensors of the elbow to thrust the water backward. The strength of the entire group of abdominal muscles is of importance, because these muscles act as a link between the power applied in the front by the arms and that applied in the back by the legs. They stabilize the body and provide a streamlined position for the trunk.

Shoulder Strength and Endurance Exercises

It is suggested that the girls begin with one-pound weights and do each exercise ten times. As the swimmer progresses, the repetitions should be increased by groups of ten until the individual can do 50. The swimmer should rest approximately one half minute between each group of ten. Weight can then be added according to the tolerance of the individual. When weight is added, repetitions should be decreased to 30; then, again work up to 50, add weight, etc.

The following exercises should be done slowly!

1. *Shoulder flexion:* Standing with arms extended at the sides, *slowly* raise the arms up in front of the body, elbows straight until the arms are parallel with the ground. Then let the arms return to the starting position slowly.

2. *Shoulder abduction:* Stand with arms extended at the sides. Slowly raise arms sideward to shoulder level and return to starting position.
3. Shoulder hyperextension: Stand and bend forward slightly at the waist. Raise arms backward, elbows straight, and return to starting position with arms hanging down in flexion.
4. *Horizontal flexion:* Lie in a supine position with arms out to the side. Raise arms upward to position of flexion. Keep arms in a position of 90 degrees to the body; lower arms slowly to position of abduction.
5. *Horizontal abduction:* Lie on table in a prone position, arms hanging down perpendicular to the floor. Raise arms to full abduction (with scapula abduction). Lower arms to a position of flexion.
6. Rotation: Lie on table in prone position with elbows fixed at 90 degrees to the body. The lower arm should be over the edge of the table with weight in hand. Keeping the upper arm fixed, move the hand as far forward and backward as possible.

Until full range of motion is obtained, assistive stretching can be used at the terminal end of movement in each exercise.

Abdominal and Back Strength Exercises

These exercises are to be done slowly to gain the maximum benefits for the posturing job these muscles must accomplish in the water. All of these exercises are done without swing or momentum. The swimmers can start out with repetitions according to their individual tolerance. All exercises should be done the same number of repetitions. When the swimmer can do 20 repetitions of each exercise, the routine should be started again at ten repetitions with five pounds weight added. This same procedure should be followed as weight is increased.

1. *Sit-ups:* The feet should be held in a stable position. Keeping knees straight, roll up, stretching hamstring muscles with maximum trunk flexion.
2. *Leg raise* (prone): The trunk of the body should be on the table in prone position. Legs are off the end of the table. Lift both legs to normal range of hyperextension, knees held straight.
3. *Leg raise* (supine): Lie back on a table with legs off the edge. Raise and lower slowly (without dropping legs) to normal range of hip flexion. *Press lower back to the table.* Do not lower legs any farther than just below edge of table top. (To guard against straining the back, caution the girls to press the lower back against the table.)

4. *Trunk Raise:* Lie prone on table with trunk (to waist) extending off the edge. Legs should be stabilized at the ankles by a partner or by a strap of some kind. Hands are placed behind the neck. Lift trunk through normal range of hyperextension.
5. *Sit-ups–knees in 90 degrees flexion:* Avoid arching back when coming to a sitting position. Roll up and roll back.

Other exercises for the purpose of flexibility and endurance can be done according to each swimmer's needs. The exercises given above for the shoulder, abdominal, and back muscles also incorporate endurance (through the increasing of the number of repetitions) and flexibility (by moving the body parts through full range of motion).

If time permits, other exercises can be used. Increased plantar flexion of the ankles permits the crawl, backstroke, or butterfly swimmer to push the water back at a more advantageous angle. A breaststroker should stretch the muscles that permit her to dorsiflex the ankles. This allows the feet to push the water backward at a point earlier in the kick.

Other exercises for flexibility include trunk twisting, forward and side stretching (standing position), sitting bounces, arm and leg lifts (lying in prone position, lift right arm and left leg, etc.), and hip swinging (lying in supine position, knees bent on chest, lower legs to right and left slowly).

Other exercises for endurance are jumping rope (25-60 times), jumping jacks, squat thrusts (5-30 times), crawl kick (two minutes), running in place, and using a rowing machine.

INTERVAL TRAINING

Interval training is designed to increase the cardiovascular endurance of the swimmer by regulating and varying the rest periods and distances to be covered. This allows the coach to vary the program and make the workouts more interesting. It is important to remember that the daily program must be flexible and based on the swimmers' performance in the water. Their mental attitude and condition are signals that serve as excellent guidelines to the daily workout sessions.

In establishing the workouts you have three variables which you control–distance, speed, and rest. At the beginning of the season the distance covered and the rest periods are longer; as the season progresses and the swimmers become conditioned, these two variables are decreased and more stress is placed on speed. The swimmers should be timed at various distances so they have some idea as to what their pace should be. Once they are able to maintain

their times at a given distance, the rest period may be decreased or their distance increased and the rest period kept the same until the swimmers are able to maintain their prescribed times once again.

SAMPLE WEEKLY WORKOUT

Warm-up swims: Individual medleys, 100's, 200's

Starts, turns, and finishes

Dry land exercises

	Distances	Repeats	Rest
Kicks	25 to 150 yds.	2 to 30	30 seconds to 3 minutes depending upon distance covered.
Pulls	25 to 150 yds.	2 to 30	
Swims	25 to 175 yds.	2 to 30	

NOTE: Twenty-five- and 50-yard kicks, pulls, and swims are done daily, with from 15 to 30 seconds rest between repeats.

The daily warm-up swims vary so the swimmer has an opportunity to swim the different distances and strokes that she will perform in a meet. By using the individual medley as a warm-up, the swimmer is acquainted with all of the strokes, and you can better guide her into the most suitable event.

Starts, turns, and finishes should be included daily. A fault in any of these three skills can mean the difference between first and last place in a meet. If the pool is small, divide the group and let Group A work on starts and turns for a time while Group B does dry land exercise, then switch groups. To ensure that the swimmers are getting off the starting block fast, time the length of time it takes to leave the block and swim full speed to a mark about two-thirds of the way down the pool. This technique will also help control breathing for short distance events if the swimmers are limited to one breath during the drill. By using the width of the pool to practice turns, the swimmers should be able to do more in a shorter period of time, thus leaving you more time to work with them on kicks, pulls, and swims. Freestylers and backstrokers should be instructed to practice turns with each hand, so that during a race they are able to turn effectively and efficiently no matter which arm is leading on the turn.

When practicing relay starts, the swimmers can also work on finishes. They learn to "swim into the wall" since their teammates are concentrating on the point they can take off without being

charged with a false start. If they glide into the finish, the whole relay team may be disqualified, thus the finish takes on added importance. This drill can be done while you are working on the 25's and 50's.

As was stated before, the team's mental attitude and condition are signals for the type of workout needed on a given day, especially before a big meet. For variety you might try water polo or, in the event that you want to keep the regular daily schedule, have the swimmers do kicks and pulls with a partner instead of the flutter board or tube. In place of the interval swims they can swim each of the four strokes in a relay or use their best stroke and do one length the first time through, then two to four lengths and back down to one length. This has been a good tapering off system for us, yet the swimmers work harder and seem to enjoy themselves more.

STROKE MECHANICS

The second objective, correct stroke mechanics, can be met through careful observation during all the drills included in your daily training program. It must be remembered that each swimmer should develop her own style and can never be a carbon copy of a previous champion. Movies, underwater observations, counting strokes per lap, and timing distance covered are all aids the coach can use to determine the efficiency of the swimmer's stroke.

In considering water resistance, the body position should be such that as small a surface as possible is presented to the water in the direction of the desired movement. In the prone strokes the head position should be altered so that only the face is in the water. Up and down movement in the water should be kept to a minimum. Arms and legs should be kept as close to the body as possible. Any quick motion under the water in the direction of the desired movement should be eliminated.

The largest body area possible should be presented to the water in the direction opposite to that of the desired movement in order to produce the maximum amount of force. The movements made in the direction opposite of desired movement should be done quickly while those in the direction of movement should be done slowly. Since the body moves in the opposite direction to that in which force is applied (Newton's law), downward pressure lifts the body, backward pressure sends it forward, pressure to the right moves it left, and pressure to left moves it right. These principles of movement can be applied to the competitive swimming strokes to produce maximum speed.

Desire is the most important ingredient in a swimmer. Those who come in second and third in swimming events but who have the

desire to continue are indispensable to a swimming team. Meets cannot be won with first place awards only. If a coach can make each swimmer feel that she is an important asset to the team, the indispensable desire to swim will be reflected in the swimmer's efforts to do her best—and what more can a coach ask?

Special Aquatic Activities

Basic Techniques for the Novice and Intermediate Water Skier [1]

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Water skiing is not only one of the fastest growing outdoor sports today but is also one of the easiest to learn. An individual's prerequisites for learning the sport include (a) the ability to swim in deep water with a reasonable degree of skill, and (b) the proper knowledge and application of the safety rules which apply to both the skier and the boat handler.

Assuming that the student has the proper equipment and has mastered the elementary techniques (the dry-land instruction for a shallow water start; the start in the water; and the proper landing after a run), the next phase of instruction is that of the deep water start. For a review of the elementary positions, see Figures 1, 2, 3, and 4.

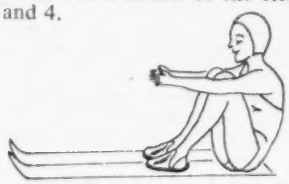

Figure 1.

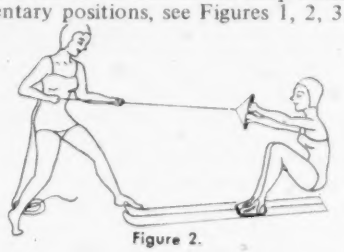

Figure 2.

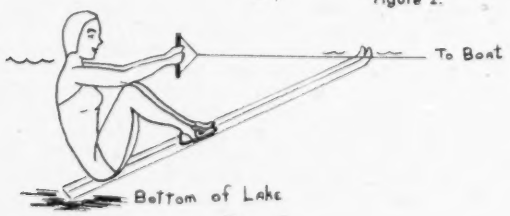

Figure 3.

[1] Beginning techniques for the water skier may be found in the 1959-61 DGWS *Aquatics Guide* article by Allen Cramer, "Skiing in Camp."

A convenient start to use after a fall to avoid having to climb into the boat and return to shore, is the deep water start. If her skis have fallen off, the skier puts them on one at a time by pulling her knees up against her chest, taking a deep breath, ducking under the water, face forward, and slipping her foot into the binding. This same procedure is then repeated for the second ski. A deep water start is similar to a shallow water start with the exception that the skier is lower in the water and the initial pull is greater. To compensate for this, the skier stays in her deep knee-bend position longer and leans forward. The skier should keep her skis as nearly parallel to the surface as possible, assuming a standing position when the tow boat reaches planning speed and she is on the surface (Figure 5).

The skier should next learn the dock start. Once the correct technique has been learned, this start is the easiest for most skiers. The skier starts by sitting on the edge of the dock, knees bent, and skis on the surface with tips up. This starting position is close to the normal planing position. She holds the tow rope handle in one hand and a coil of about 10 feet of the tow rope in the other hand or placed in the water beside her. This slack in the tow line allows the boat to get up enough speed to plane the skier, but the skier must be extremely careful to avoid entangling an arm or a leg in it on the start. The skier leans back, arms bent slightly to take the starting pull when the tow rope snaps taut. She must remember to wait for the tow boat to pull her off the dock and should not jump too soon or she will fall forward into the water. After the slack has been taken out of the tow rope, and the pull reaches the handle, the skier must lean back to counteract the forward force of the pull on the upper half of her body (Figure 6).

When the student can plane in good form and has confidence in her ability, she is ready to learn to cross the wake, or crest of water extending back in a V from the stern of the boat. The first step in crossing a wake is turning. The student should practice turning both left and right within the wake before attempting to cross it. This is done by keeping the knees relaxed, leaning into and turning the body in the direction of the turn, and applying weight on the ski on the side of the turn. After learning the turn, the student is ready to apply this same technique in crossing the wake. If crossing to the right, the student starts by first pulling to the left to give herself the most possible room. She then swings to the right and hits the wake at about a 45° angle, remembering to keep her knees slightly bent to absorb and minimize the shock. To maintain her balance, she leans forward a bit at the moment of impact. This is important because the most common error when first crossing the wake is falling backward. Before the skier swings out across the wake, she should

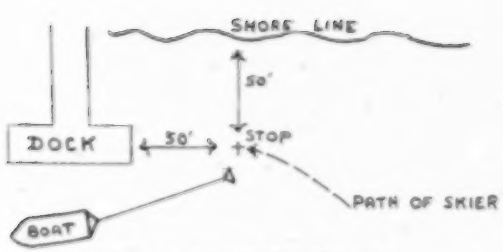

Figure 4. Proper landing after a run.

Figure 5. Deep water start.

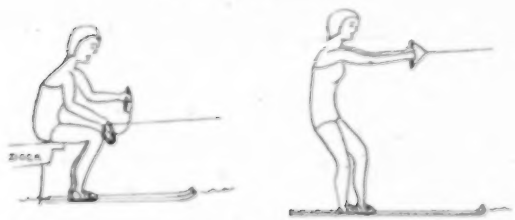

Figure 6. Dock start.

signal her driver that she is going to turn and check to make sure that no traffic is approaching.

Once outside the wake, to return, the skier pulls far outside to give herself room to maneuver, then cuts in at an angle repeating the same procedure used to go out. After the student is more accustomed to skiing, she will almost automatically jump or spring lightly just before hitting the crest. This springing takes some weight

off the skies and cushions the impact, allowing her to take the shock with knees slightly bent and weight back. Only after the student has perfected this approach to the wake should she attempt to cross it at any other angle, a 90° degree angle being her ultimate goal. This same procedure for hitting the crest of a wake is also used when hitting any rough water or wave (Figure 7).

At some point in the instructions, the student should have an opportunity to ski with another skier. When two or more skiers are skiing simultaneously, all tow ropes should be the same length. If the ropes are different lengths and the skier in back crosses, there is the danger of entangling or striking the other skier with the tow rope. The procedure used for a double or triple start is the same as a deep water start. The skiers stay in a crouched, knees bent position with skis as parallel to the surface as possible until the tow boat picks up planing speed, assuming the upright position one at a time, not simultaneously. When skiing with another skier, always remember to signal both your companion and the boat driver before attempting any maneuvers on your skis.

When all of the above techniques have been perfected, the student is ready to do simple stunts on skis. A good stunt to begin with is the Skier's Salute. The student lifts one ski out of the water at a time, making sure that the tip is up when the ski is lifted. She does this until she has the feeling of riding on one ski and can lift the ski, tip up, so that the heel of the ski is about a foot above the water. When the student feels confident, she raises the ski at a right angle to the water, holding the tow bar in the opposite hand of the lifted leg with the free hand back for balance (Figure 8).

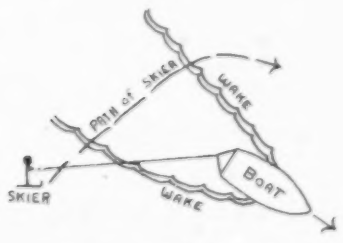

Figure 7. Crossing the wake.

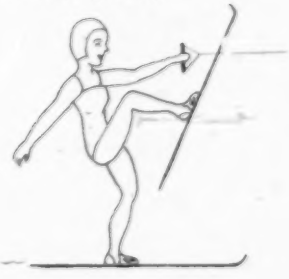

Figure 8. Skier's salute.

Skiing on one ski or slalom skiing, is the next technique to be taught. The student should start with both a slalom ski and a regular ski. The heel binding on the regular ski is loosened so that it can be

dropped when the student is planing and ready to attempt slalom skiing. She starts by easing her foot halfway out of the binding, making sure that the ski tip does not catch in the water, and finally kicking the ski off. She points the toes of her free foot backward, dragging it lightly in the water for balance. When in complete control, she slowly brings the free foot behind the other and rests it lightly on the ski, slipping it into the rear toe piece. As she gets the feeling of riding on a single ski, more weight should be shifted to the rear foot. The student next tries turning on her slalom ski, by simply leaning in the direction she wants to go, pushing the back of the ski around by shifting more weight to the rear foot, and by leaning back against the pull of the tow rope. The greater the lean, the sharper the turn. Landing on a slalom ski is the same as on two skis. The skier tosses away the tow bar, bends her knees, and drops down into the water.

To avoid having to pick up the dropped ski, the student should learn the single ski start as soon as possible. She begins this start with her ski tip up, the forward foot in the binding, and the free or rear foot trailing in the water. When ready, she gives the boat driver the signal and crouches forward on her ski in a deep knee bend position, using her trailing leg for balance. As she starts coming to the top of the water, she squeezes her rear foot forward against the pressure of the water, thus increasing her lift. When the skier is planing cleanly on one ski, she passes her trailing foot on the ski and slips it into the toe piece (Figure 9). For greater maneuverability on the slalom ski, the student should use the double-handled rope tow.

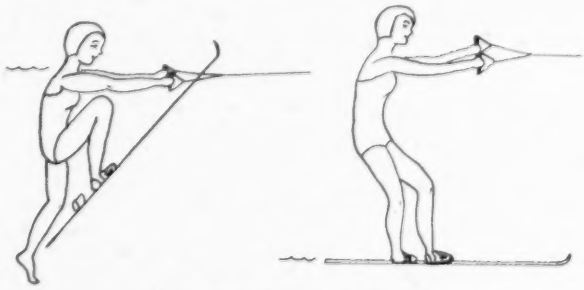

Figure 9. Starting with a slalom ski.

Kayak: Sport with a Future

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Long before the wheel or the horse were used to aid transportation, man learned to make canoes. The dugout canoe of log was man's first mode of water transportation. Although prehistoric civilization had some form of canoe, the lightest and most efficient crafts were developed in the Americas. South America produced the reed canoe in the Titicaca Lake region, while North America made three separate contributions to the development of this craft: the cedar craft of the North American Indians, the birch bark craft of the North American Indians, and the skin boats of the Arctic regions. The North American Indian appears not to have used the canoe with sails or outrigger attachments. This type of craft was developed by the South Americans of the Titicaca Lake, and by the Polynesians and South Sea Islanders. Another variation in the development of the craft was the type of paddle or blade which was used to propel the craft. The North American Indian used a single cedar blade, while the Arctic region inhabitant developed the double paddle of driftwood or other available materials.

A review of the origin of the sport canoe (see Figure 1) shows the development of two types of craft: one from the North American Indian craft, called a birch bark canoe; the other from the Arctic model which is also of the canoe class, but is a covered craft better known by the public as a *kayak*. The Europeans became much intrigued with the versatility of this kayak and developed it as a public sports craft. In fact, a Britisher by the name of John Macgregor developed and promoted the first sports kayak, known as the "Rob Roy." In 1865, he also organized the Royal Canoe Club of London, which was quickly followed by a French Canoe Club. Soon after, (1871) William Alden and Roosevelt Schuyler organized the New York Canoe Club. By 1880, William Alden was elected Commodore of the American Canoeing Association, which had been founded at Lake George, New York. Thus began the development of canoeing as both a touring and competitive sport. In North America the sport developed casually as a recreation activity but an intensive growth continued in Europe, both in terms of engineering the craft, and in developing the competitive aspects of the sport.

In spite of the fact that the craft is of North American origin, the sport of canoeing is still dominated by Europeans. The International Canoeing Federation (IFC) was founded in 1927, but it wasn't until

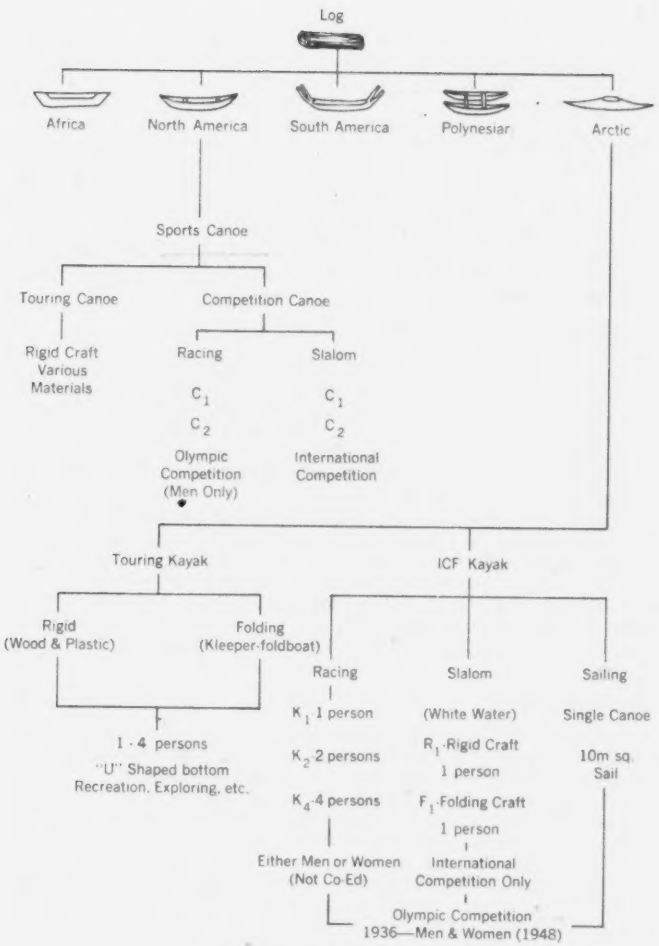


Figure 1. Origin of the Sport Canoe.

the 1936 Olympic Games in Germany that the first olympic competition in canoeing took place. The first olympic competition in canoeing for women was at the 1948 London Games, where the sport was dominated by Denmark. Since then, Finland and Russia have dominated international events for women. American women are now showing an increased interest in this sport and have had the honor of excelling in the North American competition in 1966.

At this stage of the development of canoeing as a competitive sport, it can be freely stated that the future of this sport and opportunities for participation in it are open to any American woman who has the interest and ability to school herself for this type of competition. Even in a non-competitive basis, this is a stimulating sport and leisure-time skill that can have unlimited value for the individual.

The Craft and Paddle (Blade)

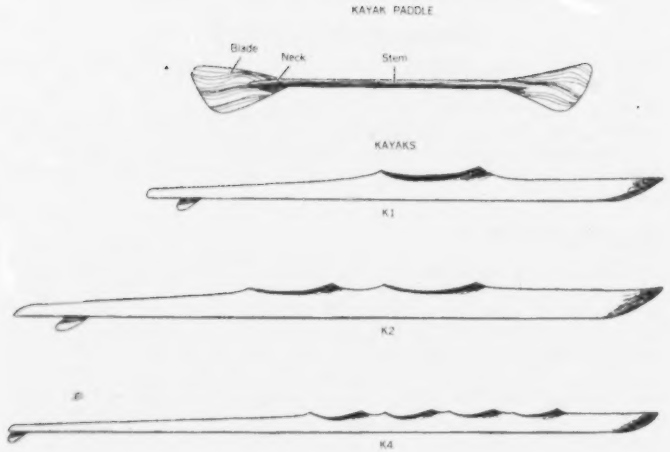
As noted in Figure 1, the canoe as a competitive sports craft is divided into two categories: the canoe, which is used in events for men only, and the kayak, which is a craft developed for sports for men and women. Henceforth, the craft which will be discussed at the greatest length is the kayak as it is used by women in competitive events. There will be only casual reference to the kayak as a recreation craft.

The kayak (Figure 2) has a pointed bow and the ends and sides are low in relation to the water; the deck is completely closed except for the cockpit. A skirt is worn by the paddler and encloses the cockpit, making the craft virtually waterproof. This craft is propelled by a double blade paddle (see Figure 3). Although the recreation and competition crafts are similar. the flat-bottom or U shape is preferable for recreation as it is more stable for casual use.

Choosing the Craft

When choosing a kayak for competition, contour, strength, water conditions, weight of the competitor, and materials should be considered. The best competitive craft is made of cedar, a light and durable material, and the most adequate trainer is of fiberglass. Although the best of both types of craft are produced in Denmark. Germany and Sweden are now offering craft of similar workmanship. The paddle consists of the stem, two necks, and two blades; the blades are set at 45 or 90 degrees of each other. The most recently designed paddle has a curved tip at the end of the blade, but there are varying designs in paddles.

The paddle which propels the craft should be as carefully chosen as the craft itself. The blade choice is based on the type of craft



Figures 2 and 3. Kayak Paddle and Kayaks

SPECIFICATIONS FOR COMPETITIVE CRAFT

Craft	Maximum Length	Minimum Width	Minimum Weight
K_1	520 cm	51 cm	12 kg
K_2	650 cm	55 cm	18 kg
K_4	1100 cm	60 cm	30 kg
C_1	520 cm	75 cm	16 kg
C_2	650 cm	75 cm	20 kg

C_1 requires that 150 cm in the front must be covered and 75 cm in the back must be covered.

C_2 requires that 292 cm of the length must be open with no more than 3 cm maximum keel depth.

used, height of the contestant, the width of the contestant's reach, and individual physique and strength in relation to build.

Commercial Names of Kayaks

Shark – This style belongs to two types as its closed deck is rounded in the front and flat at the back.
Hunter – This style used by both men and women.
Pointer – K_1 with a V shaped bottom. It is used by women and lightweight persons. It comes in both 65 and 75 kilo weights.
Ribelle – K_2 with a rounded bottom – not good for heavy people.
Liedler – K_2

Handling the Craft

The skill of handling the kayak (K_1), a fragile cedar craft of approximately twenty pounds, is based on the correct body mechanics of human movement. The craft is lowered into or lifted from the water by bending the knees with the body weight centered, grasping and holding the cockpit, and lifting the craft clear of the dock. To carry the craft, turn in the direction you wish to travel and slip the shoulder into the cockpit, resting the weight of the craft directly over the shoulder close to the neck so the weight is body-centered. Because most damage to the kayak occurs during the process of lifting and lowering the craft, caution and alertness to all possible hazards is the rule. The craft is fifteen feet long and needs space for maneuverability.

When entering or leaving a kayak, it is necessary to move carefully to prevent damage to the craft and to your dignity. Place the blade, spoon down, on the dock with the blade extending over the kayak in front of the cockpit. This helps to prevent the craft from slipping away from the dock. To enter the kayak, face the bow. Place one hand on the front of the cockpit with two fingers grasping the paddle. Place the other hand on the dock. Put the leg on the water side of the dock into the middle of the kayak in front of the seat, keeping your center of gravity over the dock until the foot is properly placed to receive your weight shift. Maintain balance as the other leg is brought into the kayak; this leg should be extended into the kayak. Immediately shift the first leg to a similar position. You are now ready to pick up the blades, hold them across the lap, and balance yourself and your craft.

If the kayak does not seem balanced, place your hands on opposite sides of the cockpit and lift the body to the desired position. The weight should be placed equally on four points: the ischia (sitting bones) and two heels, a position which leaves the feet free to handle the rudder control. The body is held very erect with a

forward lean of about ten degrees and the head well up and looking forward. More support can be gained if the knees lean slightly against the cockpit at no more than a 55 degree angle. If the knees are drawn up closer they will interfere with efficient breathing. However, if the legs are extended much beyond this 55 degree angle, the legs or hips will tend to develop muscle cramps. This seated position is particularly important to the competitive paddler because a slumped or incorrect position can seriously interfere with efficient paddling.

Paddle Control

The correct grip on the paddle is obtained by lifting the arms to the side at shoulder height with elbows bent at 90 degrees and the forearm parallel and horizontal to the shoulders. The hands then grip the paddle at about the center one-third.

The blades are at a 90 degree position to each other. The controlling hand remains loosely fixed on the shaft so the paddle will rotate between the thumb and fingers. The paddles are made for right or left hand control. To identify a left hand paddle, hold the paddle in a catch position in the water. The shorter side of the paddle will be in the water and the blade on the other end will face upward, spoonlike. A right hand paddle will be the reverse. The efficient paddler should be able to use either paddle with equal dexterity.

Propelling the Craft

The correct stroke is described by the late Kalman Blaho, former Hungarian Olympic canoeing coach, in the *Proceedings of the Second National Institute on Girls' Sports* as follows:

1. To get the blade into the water one should reach as far as possible. Keep the blade facing at right angles to the keel (square to the water) to help gain maximum surface area for the pull. To accomplish this, the right shoulder is forward and down. The left hand is high, so that the action is almost one of coming down from above in a two-handed spearing motion. The action is fast and light so as not to retard the forward motion of the craft. It might be described as feeling like "cutting butter" (see Figure 4).
2. The blade is brought backward along the craft in nearly vertical position. To accomplish this, the right hand pulls backward close to and parallel to the kayak while the left arm is punching forward at forehead level to maintain the perpendicular position of the paddle. The left hand does not cross over to the right side nor drop lower at the end of the stroke.
3. The blade is lifted from the water by flexing the right elbow and hyperextending the wrist. The elbow remains low, and the left arm remains high and slightly to the left of the midline of the craft. Do

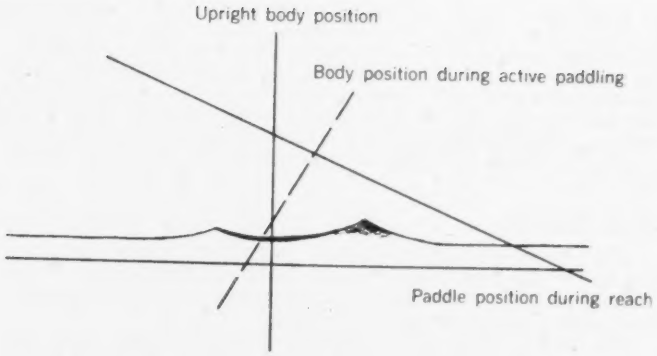


Figure 4. Body and Paddle Position for Correct Stroking

not lift the paddle by lifting the right shoulder or lowering the left arm.

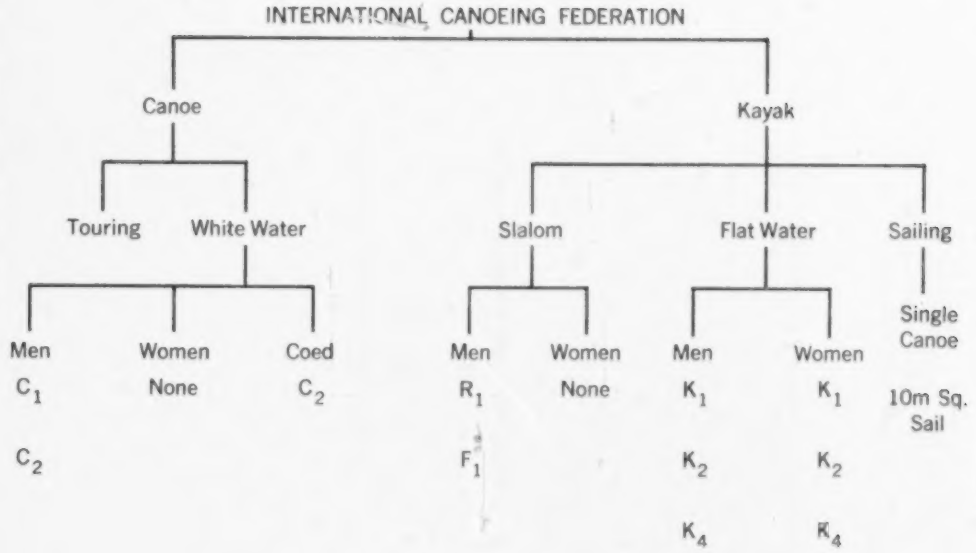
4. The left hand is kept high as the right hand comes forward above the head. The movement then continues by swinging the paddle into position to "dive" into the water in as vertical and forward a position as possible.
5. The knees are working parallel to the longitudinal axis as you are pushing and pulling. On the side that is reaching forward, the knee is pulled up, and then straightened as the pull through the water occurs. The body and legs move about the four points of contact.

Physical Conditioning

It is necessary that the competitive paddler be in the best possible physical condition, with emphasis on endurance. An active program in swimming, running, team sports, gymnastics, and skiing will comprise an excellent maintenance program which is later intensified with special exercises and weight lifting of the type used by swimmers. (This weight should not exceed twenty pounds.)

Perfection of the stroke is an absolute for this sport. I have found the following suggestions invaluable:

1. Place a mirror in front of a paddler seated on the floor. Mark the mirror at forehead level as a guide and use a 48" stick for a paddle.
2. Place a mirror in front of a paddler seated on a long bench.
3. Place a mirror in front of a paddler seated in a kayak which is attached by a rope and a tension cord to a lane marker. The paddler uses a slow stroke, i.e., one stroke to every two seconds.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Canoe
Kayak
Touring
White Water
Slalom
Flat Water
Sailing
Men
Women
Coed
Men
Women
Men
Women
Single Canoe
C1
None
C2
R1
None
K1
K1
10m Sq. Sail
C2
F1
K2
K2
K4
K4

Figure 5

4. Have the paddler paddle the kayak in a lake and observe her front, back, and side. Discuss the body position, paddle position, reach, and recovery. Speed in the kayak will come only after perfection of the skill and by quick movement on the recovery of the stroke.

Competition

All national and international competitive events for women are 500 meters (approximately 547 yards). When the K_1 can be handled at 2:15, the K_2 at 2:02 and the K_4 at 1:50 for the 500 meters, the college woman can plan to enter competition with the best of the women competitors of North America (see below).

At the present time, the only competition in the United States is in the summer and early fall, sponsored by the American Canoeing Association and affiliated clubs (see Figure 5). Although it may be some time before canoeing is offered in planned college competition, this sport could certainly be included in a physical education or recreation program at no greater cost than any other activity, making it possible for the interested student to join a canoe club and participate in the canoe association.

Events for International Competition

10,000m	K_1	K_2	K_4	C_1	C_2	Men
1,000m	K_1	K_2	K_4	C_1	C_2	Men
500m	K_1	K_2	K_4			Men
500m	K_1	K_2	K_4			Women

(500m–Approximately–547 yd.)

Girls-Let's Play Water Polo

RUTH ASHTON JOHNSON
Davenport, Iowa

Water polo originated in England in the 1870's and was introduced in the United States in 1888. The sport was exhibited in the 1900 Olympics and officially added to the list of Olympic events in 1904. Hungary, the chief water polo country in the world, won the Olympics in 1952, 1956, and 1964, and placed second in 1960. The sport is especially popular in Europe, where crowds of 5,000 or even 10,000 gather to watch championship matches played in large, stadium-like outdoor pools. Since 1961 water polo has been revived in the United States as a sport for women.

American girls engage in activities with balls of all kinds, yet how many of us have introduced balls in the acquatic medium? Most of our girls love to play basketball and all good swimmers love to play water basketball if given the chance.

Water polo is an aquatic sport that develops and promotes the eye-hand coordination of ball handling in addition to most of the basic swimming skills. It is a game that requires and helps develop a wide variety of skills. Balls furnish great motivation for skill development at all swimming levels both through their use and in withholding their use. Students will work harder in class if they can play at the end of the period. Ball handling has no equal for developing freedom of movement in the water. Lead up and practice drills for water polo may be used as a whole skill in themselves or as practice for the game.

Do you send your swimmers on lengths of head up front crawl in preparation for life saving? Put a ball between their arms and dribble it as a race. Then step back and watch the increased motivation; strength and skill develop with little effort from you! Do you have your swimmers tread water to develop strength? Give them a ball to play catch with and they will tread water literally for hours—and be disappointed when you call them to stop. Do you have swimmers who insist on crossing their arms completely across their body on the front crawl? Give them a ball to dribble and automatically their elbows will become higher and their arms will straighten. If this doesn't happen they can't dribble. It only takes a short time and saves so many words.

Dribbling is first accomplished by placing the ball between the arms of the swimmer and bumping it forward with the forehead, nose, or chin. The arms should prevent sideward motion. As the swimmers are able to swim faster, the ball is carried forward on the

bow wave and should not touch any part of the swimmer's body. The arms may then be used to control the ball when changing direction. Dribbling should be practiced while swimming in a straight line and while zig zagging.

Ball handling skills, lead up drills to water polo, and water polo itself are excellent for developing endurance for life saving or competitive swimming. These games provide a fun activity at the end of a class and an opportunity for development of sportsmanship, democratic process, leadership and team play.

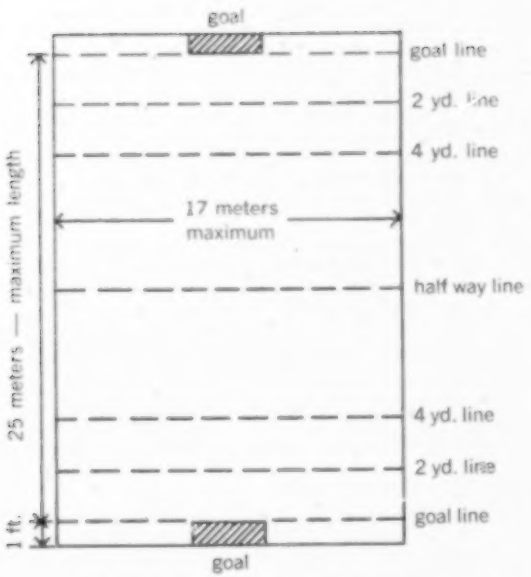
Equipment[1]

You need two officials sticks–a stick about two feet long with a blue flag at one end and a white flag at the other end–and two different colors of caps (one set can be spray-painted blue). Any balls will do at first. Rubber volleyballs or soccer balls are the best substitute for an official water polo ball. Goals can be approximated with chairs or other markers. These should be ten feet wide, four and one half feet above the water level in the deep end, and eight feet above the bottom of the pool in the shallow end. Goals must be made to fit each individual pool. If you have a large pool, the maximum size of the field of play should be 25 meters by 17 meters. Mark your goal line one foot from the end of the pool, and mark a two and four yard line at each end and the half way line.

Basic Water Polo Rules

1. Five to six players on a team work well in a four lane pool. Seven is the official number for a six lane pool. However, in a classroom situation more can be added to fit the needs of the class.
2. The game is divided into four quarters of six minutes each. Teams change ends each quarter. There are two minutes between quarters and five minutes between halfs.
3. The game is started at the beginning of each quarter by a swimoff. The teams line up in the water at the ends and start toward the center on the official whistle. The ball is then thrown into the middle of the pool. After each goal the teams line up on their own side of the center line and the ball is given to the team that did not score. The first pass at this time must be backward.
4. The object is to throw or dribble the ball through the opponent's goal. One point is scored for each successful goal.

[1]Simplified adaptations of NCAA and AAU Rules.



TYPICAL WATER POLO FIELD OF PLAY

5. Substitutes may enter from behind their own goal with the official's permission after a goal is scored or at the beginning of a quarter.
6. If the ball goes out of bounds at the side, it is awarded to the opponents of the team that touched it last. It must be put into play where it went out. When it goes out of bounds at the end line last touched by the defenders, it is awarded to the attacking team on the sideline at the two yard line. When last touched by the attacking team, it is awarded to the goalie in the goal.
7. *It shall be a minor foul*–
   a. For any player except the goalie to hang on to the side, stand up, or push off the bottom of the pool when taking an active part in the game.
   b. For any player except the goalie to touch the ball with two hands.
   c. To take the ball under water.

d. To deliberately splash water at an opponent.
e. To waste time by failing to assist the normal procedures of the play. (*Note:* The responsibility for returning the ball to the player who is taking the free throw is primarily that of the team to which the free throw is awarded. The opponents have no duty to do this, but they may not deliberately throw the ball away.)
f. To impede the free limb movement of an opponent by swimming over her back, legs, or arms.
g. To hold, pull back, or sink an opponent not holding the ball.
h. To push or push off from an opponent.
i. To strike the ball with a clenched fist.
j. To go into the opposing team's two meter area unless preceded by the ball.
k. For the goalie to go past the half way mark or to throw the ball past the half way mark of the field of play.

8. *Penalties for minor fouls.* The opponent who was fouled shall put the ball in play by a free unguarded pass taken at the spot where the foul occurred. The ball may also be dribbled; however, a definite motion of putting the ball into play must be made.
9. *It shall be a major foul–*
   a. To attack, strike, or kick an opponent in such a manner as in the opinion of the referee, to endanger her person in any way. Deliberately throwing the ball at an opponent constitutes such an attack. A player in possession of the ball may be tackled, but may not be attacked in violation of this rule.
   b. To refuse obedience to the referee or to exhibit unsportsmanlike conduct.
   c. To deliberately interfere with the taking of a free throw, penalty throw, or corner throw.
   d. To commit any foul within the four yard area but for which, in the opinion of the referee, a goal would have been scored.
10. *Penalties for major fouls.* The penalty for a major foul shall be one penalty point. For each three penalty points a penalty throw shall be awarded. If the foul was in the four yard area, a penalty throw shall be awarded in place of a penalty point. When a major foul occurs, the offending player may be ejected from the game. If, in the opinion of the referee, it is serious enough to warrant her ejection for the entire duration, no substitute shall be allowed for this player.
11. *A penalty throw* is an unguarded throw at the goal from the four yard line. Only the goalie may be in front of the four yard

line. All other players must be at least two yards away from the player taking the penalty throw. The throw must be made on the referee's signal.

12. When a double foul occurs, the players face each other and the ball is thrown between them. The ball may not be played until after it hits the water.

Officials

1. There should be two referees who shall be in absolute control of the game. Their authority over the players is effective during the entire time the game is in progress.
2. All decisions of the referee are final. She may alter a decision providing she does so before the ball is again in play.
3. The referee has the power to order from the water any player for flagrant misconduct or for disobeying her authority. Should a player refuse to leave the water when told, the game should be stopped and the victory awarded the opponents.
4. The referee may refrain from calling any foul if in her opinion the call would be an advantage to the fouling team or player. Her interpretation of the rules shall be the rules for that particular game.
5. The referee calls fouls by blowing her whistle and signaling with her stick. The flag of the team that is to receive the ball is pointed to the exact spot that the foul occurred and the ball shall be put in play at that point by the player who was fouled. (*Note:* The flag should actually preceed the whistle.)

General playing hints

1. The best method of moving the ball is by fast dry passes. Dry passes are from the hand of the passer to the receiver and do not touch the water.
2. The best wet passes are those thrown to a breaking swimmer and which land ahead of and between their arms.
3. Always raise as high as possible out of the water when receiving, passing, or shooting. The non-shooting hand should scull for balance and added power.
4. Never allow your body to drop to a vertical position. Always remain high and in swimming position especially when the flag is out.
5. When a foul is called, immediately look for the color. If it is yours, get the ball in play immediately; if it is your opponent's, move rapidly to defend.
6. When a foul is called against you, never get the ball for an opponent unless directed by the referee.

7. Always keep in mind the basic offensive moves—pass and break.
8. Make every attempt to force all play to the outside when the ball is near your goal.
9. When guarding an opponent, always attempt to steal the ball by going under her arm; never go over her shoulder.
10. Always go for the arm, elbow, or ball when your opponent is shooting. Play the ball, not the player.

Publications and Sources of Information

1. *AAU Swimming, Diving and Water Polo Rules,* AAU House, 231 West 58th St., New York, New York.
2. *A Guide to Water Polo* by David Barr, Swim Central, 44 Grand, London, Ontario.
3. *Water Polo Drills and Playing Hints,* by W. K. Anttila, National Press, 850 Hensen Way, Palo Alto, California.
4. *Water Polo: The Art of Shooting* by Dick Newman, St. Louis, Carondelit YMCA.
5. *Playing Your Position in Water Polo,* by Charles Hines, Canton, Illinois YMCA.
6. *Report on Midwest Olympic Development Water Polo Clinic.* A talk by Art Lambert, Paul Hutinger, Swim Coach, Western Illinois University, Macomb, Illinois.
7. *Water Polo.* An excellent, 30 minute film, color and sound, covering drills and playing techniques. G.N. Productions, 2112 Lyric Ave., Los Angeles, California.

The Aquatics Program as Seen by the Camp Director

KRIS HANSEN
Center Lovell, Maine

From the administrative point of view, there are many areas to be considered when planning and constructing a total camp waterfront program. These areas encompass the physical layout of the waterfront, the hiring and training of the staff, the financial investment involved, the integration of all phases of the waterfront program with specific program planning for each department, and the formulation of individual camp policy concerning the aims and objectives of the camp and, most important, the safety of each individual child.

There are many different types of camps in operation today. In many cases the type of camp fosters the objectives which ultimately affect the functions and aims of the individual departments and their importance in the total camp program. Whatever the objectives of the camp director, she should advocate primarily the progress and well-being of the child.

The Physical Layout of the Waterfront

The physical layout of a camp's waterfront is in part determined by the natural contour and formation of the land involved. It is a fortunate camp that can begin its waterfront construction with a hard sand base and a gradually sloping bottom. If ideal circumstances permit, there should exist a minimum of 600 feet of lake front property to carry on an active program encompassing all waterfront activities such as swimming, canoeing, sailing, water skiing, and possibly crew. Our considerations as administrators are that:

1. There is ample dock area to service the entire camp at one time such as for general swims.
2. These docks are of the proper material and constructed so that there is no safety hazard.
3. These docks are so aligned that they are in advantageous positions for teaching.
4. There is ample storage space for all boating equipment properly located to prevent interference while engaged in teaching an activity.
5. There are no water traffic conflicts such as the water ski take-off area crossing in front of the canoeing teaching area.

6. The waterfront is supplied with the latest and most complete safety equipment, such as ring buoys, poles, lines, first-aid equipment, and patrol boats.
7. A staff capable of handling all of the above to the fullest capacity is hired.

Hiring and Training of the Staff

This area of consideration is perhaps the most important part of the whole construction of the program. The quality of the staff can make or break a program and therefore can make or break a child's desire to participate in the total camp program. In the hiring of all camp staff it is most important to screen the applicant thoroughly either through personal interview or consultation with someone who is familiar with her. Here is a list of questions a camp director asks herself when considering a candidate for a waterfront position:

1. What is the age of the applicant? It is most important to maintain a high standard of maturity in counselors. At least one year of college is desirable as a prerequisite. A waterfront director should be at least 24 years old, and preferably over 25.
2. What are her specific qualifications? Is she a certified American Red Cross Water Safety Instructor? Does she have small craft certification? These are essential considerations for each department.
3. Is she versatile on the waterfront? Can she efficiently handle a canoe, sailboat, or power craft even though she is applying for a swimming position?
4. Is this person safety conscious?
5. Has she had any experience with children?
6. Is her personal appearance commendable? Does she dress neatly and tastefully? Is she well groomed? Counselors must present themselves as examples to the children even on the waterfront.
7. Does the applicant seem to be enthusiastic about aquatics and children and what she can do for the camp?
8. Will this person be flexible enough to meet the needs and interests of those involved in the camp situation? It is most important that a new person coming into an established camp abounding in traditions be able to accept those traditions and to contribute further to them rather than seeking to change everything immediately.
9. Of what caliber are the applicant's recommendations from her school or previous places of employment? Do these recommendations mention such personality factors as: judgment, loyalty, honesty, sincerity, initiative, stamina, willingness to work, willingness to help out in another department if necessary?

10. Does this person have the ability to love children and provide the utmost in respected leadership?
11. Could this person contribute to the camp as a whole? Beware of the candidate whose first questions to you are: "How much time off do we get, and how's the social life?" These questions should, by all means, be answered in the course of the interview by the director, but the candidate's first consideration should be her job and what she can contribute to it.

There is the possibility of running into a qualified applicant who has all the personal requirements and potentialities of an excellent waterfront staff member but does not have the formal training or certification necessary for the proper direction of children. One way of solving this problem is by sending these people to either aquatic or small craft school prior to camp's opening. Here the camp and the individual mutually benefit.

Camps are dealing with a most precious commodity when they deal in the leadership of children. The campers deserve the best. Start with the finest leaders.

Expense of Waterfront Construction

Needless to say, the financial investment for any given waterfront is going to differ with each camp involved depending upon geographic construction problems and the importance of the role to be assumed by the waterfront as a part of the total camp program.

Generally speaking, most camps are one step ahead financially, since the biggest item, water, is usually already present in the form of a lake or dammed up river. The major investment comes in the construction of the docks, and storage and maintenance of small craft. There are many ways in which a camp director can keep her budget to a minimum and yet have an efficient arrangement. First of all, investigate materials in the construction of the docks. Many docks are now removable for winter storage. Many new types of sealers are used to preserve the woods for maximum life span. It has been found that the staff actually enjoys a period before and after camp which is called work camp. One or two professional people are hired to supervise, but the staff assumes the bulk of the work on construction and boat maintenance. In this manner the staff experiences a togetherness which might otherwise take weeks to establish. The counselors become aware of methods of construction and maintenance and will be able to tackle much of the repair work themselves during the season.

Again, it is a fortunate camp director who finds a person of great initiative as a waterfront director. This is a key person and she should be encouraged to the fullest. If she wants to dress up the waterfront for a meet, let her! If she wants to build regulation diving

take-off standards, let her! If she wants a starting gun, get it! The small points add up to an outstanding program which the camper will remember.

A waterfront director's primary concern should be the swimming program and its initiation, but she should also have an acute awareness of the canoeing, sailing, water skiing, and crewing programs. There will be instructors in charge of these specific activities, but they should be directly responsible to the waterfront director who knows at all times what activities are going on and what boats are in use. At all times during the day she has a "third" eye out for a capsized sailboat or a canoe in trouble. She should be present at all departmental meetings and should have the right to call such meetings. This person should have been sent to small craft school by the camp so that she too has a working knowledge of small craft requirements and safety. The integration of all aquatic departments brings about a complete and whole waterfront program.

In one particular camp, enough people are hired on the waterfront so that the boating, canoeing, and sailing trips are covered and counseled by water safety instructors as well as small craft instructors. This maintain safety standards and provides a necessary break in pace from time to time for the swimming instructors.

It is also a good idea to integrate a counselor-exchange program. From time to time the canoeing people may give an instruction session to the swimming people, and the swimming people may give an instruction session to the sailing people. In this way each department begins to feel an important entity and sharing of information which carries over to the children. It is amazing how interested a child will become in canoeing if she knows that her tent counselor is interested in learning too and can share an instructive conversation.

Program Planning for Each Waterfront Department

If you were to ask a camper: "Why did you come to camp?" her answer would probably be: "To have fun and to learn a lot of things." These two things cannot be ignored in a good, well-rounded program. The ideal situation is to meet the needs and interests of the child and to do the best possible teaching job in these areas while having fun doing it. Each waterfront area should have a scheduled program of activity with some form of incentive for the child, be it an award system, working for a place on a trip, or whatever the tradition of the camp demands. The program should include an interested and happy counselor, active participation whatever the weather, a bit of competition (all children need this), and a

culmination in the form of a sailing or canoeing race, or a swimming meet at the end of the season.

The camp director should meet with the heads of the departments during the winter season to construct a skeletal plan so that each department can become a part of the total camp program. The details and physical technicalities can be met and taken care of during work camp and orientation.

Each individual departmental program should cover as many phases of the instructional and recreational parts of the subject involved as possible. For instance, the swimming department should not only cover the teaching of standardized strokes but also should include such things as synchronized swimming and water ballet, skin diving, springboard diving, and water games. Some spontaneous competitive work is also in order. The canoeing department should provide training in the handling of the canoe, but the campers should also be permitted to strip down and re-finish an old canoe, perhaps as a rainy day project. The same principle is applicable to the sailing department. Sailing races are always a good culmination but nothing is more fun than a sailing overnight! All of these things are possible within a well-planned program, and this planning must go on all through the winter.

The Camp Policy

The camp policy concerning the waterfront could almost be summed up in one word: safety. It is imperative that each member of the waterfront personnel have an awareness of both the safety of the moment and of the moment to come. All rules and regulations should be outlined and discussed with the camp director, then carried to the entire waterfront staff by the waterfront director, and thereafter enforced by all staff and campers alike.

If the proper approach to understanding of and respect for the regulations is presented, it is inevitable that the camper will have the "time of his life." Too many little rules can make for an unhappy situation but a few firm rules and an alert staff can provide a safe and pleasurable experience for all.

The camp waterfront can and should be a focal point of camp activities. It should encompass as many activities, both instructional and recreational, as possible. All teaching abilities and capacities of the staff should be encouraged and utilized. There should be no fear of experimentation if the basic program is sound. Camp is an excellent proving ground for people who wish to try new teaching methods and variations in activities.

TECHNIQUE CHARTS

Diving, 1969 (243-08048)

Swimming, 1971 (243-25130)
Available Spring 1971
Price To Be Announced

1971-73 AQUATICS GUIDE
(243-0776)

Available July 1971

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